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METEOROLOGY OF AUSTRALIA.

COMMONWEALTH BUREAU OF METEOROLOGY,

MELBOURNE.

THE REMARKABLE FLOOD RAINS OVER SOUTH-EASTERN AUSTRALIA

DURING

THE WINTER OF 1909.

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(ISSUED NOVEMBER, 1909.)

Published with the Authority of the Minister of Home Affairs under the direction of

H. A. HUNT,

COMMONWEALTH METEOROLOGIST.

By Authority:
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THE FLOODS OF AUGUST, 1909.

The following pages contain (Section I.) a brief review of the present winter meteorological conditions and the antecedent general weather over the Commonwealth during the present year, and (Section II.) an account of the heavy storms and flood rains which occurred in south-eastern Australia during the month of August, 1909. Explanatory graphs or charts are included showing—

1. The rainfall over south-eastern Australia during August.
2. The areas affected by the flood waters.
3. The heights reached by the flood waters on the Murray and its tributaries.
4. The daily weather charts during the passage of the cyclonic flood storm across southern Australia.
5. Graph of the barometric fluctuations at the capital cities during the progress of the storm ;

and to make the Bulletin more complete for reference an appendix has been added giving comparative tables of flood data which were collected by the late Mr. H. C. Russell, formerly Government Astronomer for New South Wales, and which have been amplified and brought up to date. The tables and remarks on the rainfall given in the text are based upon the returns and figures at a number of stations throughout the Commonwealth specially selected as representative of the different States.

It may be mentioned that, in order to mitigate the damage likely to be done by the anticipated floods during the month of August, this Department took the precaution to issue warnings of floods, heavy rains, and rising rivers on the following days :—

August, 3rd
,, 4th
,, 5th
,, 6th
,, 10th
,, 11th
,, 12th
August, 14th
,, 19th
,, 20th
,, 26th
,, 27th
,, 28th
,, 29th

It also, on occasions, advised the Railway and Police Departments, which, by the aid of their officers in all threatened districts warned settlers by all available means to remove live stock and properties to higher ground. The Bureau also distributed to the Country Press and Post Offices, tables showing the danger water levels at all available points along the Rivers.

But for these precautions, it is estimated the loss to our community would have been very considerable, as subsequent surveys proved the principal loss sustained was by the damage done to the roads, bridges, and permanent railway, most of the graziers availing themselves of the ample warnings given to remove their stock to higher levels.

SECTION I.

The winter season over sub-tropical Australia generally was cold and wet, the rains on the whole being not only well above the average, but spread over an unusually wide area and including also within their range the greater part of tropical Australia, where, under normal conditions, little or no rain falls at this time of the year. This was more especially the case during June and August, for in the midwinter month (July) it was relatively dry and (except along a strip of the southern coast line) the falls were below the normal. During the two previous months (April and May) rains had been copious in Victoria and Tasmania, and throughout South Australia in the latter month, and in June the area of heavy rainfalls widened and embraced not only southern, but all western, central, and the greater part of eastern and northern Australia. In Queensland the average fall from selected stations during this month (June) ranged from 66 points in the western to 286 points in the Maranoa district, in New South Wales from 170 in the far north-west to 609 on the south coast, in Victoria from 266 in the Mallee to 697 in the north-east, in Tasmania from 298 in the Midland to 860 on the west coast mountain regions, in South Australia from 176 over the Murray Valley to 404 in the upper north agricultural areas, and in Western Australia from 114 in the West Kimberley district to 522 in the south-west. In the Northern Territory no rain fell between Port Darwin and Daly Waters, or in East Kimberley. Compared with normal falls these June rains exceeded the average over the whole of the continent, except on the east coast between Townsville and Newcastle, on the south coast between the Bight and Kangaroo Island, and over the western half of Tasmania.

The distribution of the August rains, which were generally much heavier and equally widespread, is given in the following table, which shows the mean rainfall taken from representative stations, over each of the 57 districts into which the Commonwealth has been divided, the normal district falls, and the percentage of this month's fall above or below the normal :—

District.	Mean District fall, August, 1909.	Average of previous years.	Percentage above or below Average.
West Australia.	Points.	Points.	
East Kimberley	42	3	+ 1300
West Kimberley	0	6	− 100
North-West	18	36	− 50
Gascoyne	255	79	+ 223
South-West	671	386	+ 74
Eucla	398	185	+ 115
Eastern	219	88	+ 149
South Australia.			
Northern Territory (Upper)	85	5	+ 1600
Northern Territory (Lower)	85	25	+ 240
Far North and North-West	112	51	+ 120
Western	342	160	+ 114
Upper North	244	143	+ 71
North-East	91	79	+ 15
Lower North	455	198	+ 130
Central	568	277	+ 105
Murray Valley	353	146	+ 142
South-East	431	295	+ 46
Queensland.			
Peninsula	14	14	0
Carpentaria	15	22	− 32
Western	155	24	+ 546
Central	177	63	+ 181
North Coast	169	206	− 18
Central Coast	49	95	− 51
South-East Coast	317	183	+ 73
Darling Downs	265	146	+ 82
Maranoa	386	86	+ 349
South-West	333	68	+ 390
New South Wales.			
West (Upper)	248	93	+ 167
West (Lower)	164	111	+ 48
North-West Plains	390	142	+ 175
North-West Slopes	488	204	+ 139
North Tablelands	364	194	+ 88
North Coast	175	340	− 49
Hunter and Manning	201	337	− 40
Central Tablelands	235	248	− 5
Metropolitan	87	258	− 66
Central West Slopes	375	211	+ 78
Central West Plains	353	146	+ 142
Riverina	258	151	+ 71
South-West Slopes	376	219	+ 72
South Tablelands	194	226	− 14
South Coast	109	285	− 62

District.	Mean District fall, August, 1909.	Average of previous years.	Percentage above or below Average.
Victoria.	Points.	Points.	
Gippsland	371	301	+ 23
North-East	545	317	+ 72
Central	505	233	+ 117
North Central	618	244	+ 153
North	412	197	+ 109
Mallee	290	129	+ 125
Wimmera	493	193	+ 155
Western	531	305	+ 74
Tasmania.			
North	650	371	+ 75
West Coast	1124	833	+ 35
Central Plateau	215	256	– 16
Midland	276	166	+ 66
East Coast	335	270	+ 24
Derwent	296	177	+ 68
South-East	332	204	+ 63

The graph of the August rains given at the end of Section II. shows the general distribution of the fall during the month over south-eastern Australia. In New South Wales the maximum amount recorded among the selected stations under review was 708 at Bingarra, on the north-west slopes of the ranges. In Victoria it was 12·53 at Harrietville, in the north-eastern highlands; and in South Australia 11·24 at Stirling West, in the Mt. Lofty Ranges; and, except along the east coast from the Gippsland Lakes northwards, every station in south-eastern Australia recorded above the normal fall. In South Australia, where the mean fall in the settled districts ranged up to more than double the normal, and in Victoria, where the greater part of the State had from two to two and a half times the amount which normally falls in August, this month will rank as one of the wettest on the records. At Stirling West, where the maximum fall for South Australia occurred, the total for the five months, April to August, was 47·06 inches (or 17½ inches above the average), which is ½ an inch more than was recorded during the same period in 1889, a memorable flood year, and at the Adelaide Observatory the total for the month—5·59—is greater by over an inch than any previous August fall on the records (which go back to 1839). In New Zealand, also, it may be here noted, August was very wet, the fall being 75 per cent. in excess over the North Island taken as a whole, and 30 per cent. over the South Island.

The rains were not only abnormally heavy, but well distributed through the month, though the rain-producing storm systems were actually few in number (only four), but they moved slowly, developed well inland, and the path followed by their centres was further north than usual, all passing over or very little south of Tasmania. Each of these disturbances was marked by cold, wet, and stormy weather, but the storm tendencies of the month culminated on the 19th in torrential rains and fierce thunderstorms, which caused one of the most disastrous floods Victoria has ever experienced.

The Cyclonic Storm of August 16–21.

The graphs appended to this Report include a series of the 9 a.m. weather charts during the passage of an extensive storm system of cyclonic energy which traversed the whole of subtropical Australia, from Cape Leeuwin to Gabo, between the 16th and 21st of the month, and was the main factor in the development of the exceptional storm rains and floods now under review. Moving over an area already saturated by a period of almost constant rain—for scarcely a day passed during the previous fortnight without widespread and at times heavy downfalls, especially in southern and south-eastern Australia—its effect was most disastrous, and creeks and rivers, already swollen, were turned into raging torrents, which overflowed their banks, and spread ruin and desolation over the surrounding country. The map of the 16th shows the advent of the disturbance, which had rapidly advanced from the southern Indian Ocean during the previous 24 hours, in the extreme west of the continent. Its centre was then off the south-west coast of Western Australia, the embracing isobars being somewhat irregular in shape and gradients moderate, and its rain area covered the whole of that State south from the tropic with heavy falls near the coast (Perth 213, and 23 other stations from 1 to 2 inches). Next morning (17th) the centre occupied much the same position, but the gradients had lessened, and the isobars indicated a tendency to form a double-headed depression, and another general, though less heavy, rain was registered, south from about the latitude of Geraldton. On the 18th the gradients had still further declined, but the low area had assumed a definite V-shape, with its apex intruding well inland to much lower latitudes than on the previous day. This carried the rain, which was again general, on to the tropic, though the area of greatest precipitation was still in the south-west (Perth 141, and nine others over an inch). The chart of the 19th shows that the storm area had made a distinct surge eastward to the South Australian coast, with an extension of its isobars into still lower latitudes, and a general intensification and steepening of the gradients. A new High Pressure Area of considerable energy had developed over Western Australia, which stimulated the circulation in the rear of the disturbance, whilst the stationary anticyclone on the east coast and the Tasman Sea maintained velocities in the advancing side. Very disturbed weather was anticipated, as this type of chart (19th) showing a deep cyclonic V area, wedged in between two energetic anticyclones with isobars running approximately north and south, is a very favorable forerunner of widespread rains on the Australian continent, and the subsequent conditions more than realized these anticipations. Up to the 18th the disturbance was marked by heavy rains, though only moderate winds, but on that day it began to develop cyclonic and electrical energy, and its subsequent career was accompanied by most violent atmospheric commotion. On the night of the 18th violent thunderstorms, with fierce squalls and heavy rains, broke over the outlying north-west and western areas of South Australia, and rapidly swept across the State into Victoria, rain falling at 163 stations in South Australia up to 9 a.m. next morning (19th), of which 52 registered between ½ and 1 inch, and 55 over an inch (maximum 168 at Streaky Bay, on the west coast), and at 135 stations in Victoria, of which 26 recorded between ½ and 1 inch, and 21 others over an inch (maximum, Dimboola, 183). The rain area had also widened considerably, for light rain was still falling in Western Australia, and commencing in Tasmania. On the 20th the storm reached its greatest intensity, its cyclonic centre being clearly shown to the south of Victoria and near the north-west corner of Tasmania (barometer at Stanley, 28·96 inches), with exceptionally steep gradients. Along the south-east coast of South Australia the previous night the weather was extremely wild, with winds of hurricane violence, and exceptionally low barometer, and rain fell throughout the whole of South Australia, Victoria, Tasmania, and New South Wales, and extended into the south-west and south of Queensland, being recorded at 155 stations in South Australia, of which 56 registered from ½ to 1 inch, and 8 over an inch (maximum, Uraidla, 169); at 156 stations in Victoria, of which 55 had between ½ and 1 inch, 56 from 1 to 2 inches, and 18 others over 2 inches (maximum, Kyneton, 325); at 31 stations in Tasmania, 9 being from ½ to 1 inch, 9 from 1 to

2 inches, and 3 over 2 inches (maximum Burnie, 271); at 140 stations in New South Wales, of which 46 records were between ½ and 1 inch, and 10 over 1 inch (maximum Tumbarumbah, 181); and light falls at 44 stations in Queensland. The last chart of the series shows that the disturbance has regained its V-shaped form, has lessened in intensity, and passed eastward to the south Tasman Sea; whilst at the same time the accompanying anticyclones have considerably exhausted their pressures and lost all controlling character.

The diagram of barograph curves recorded in the southern capitals indicates the successive pressure readings experienced during the passage of the disturbance. It also shows the times the axis of the storm took to travel from city to city in an easterly direction across the southern parts of the continent. The minimum of 29·74 inches was registered at Perth at about 3.30 p.m. on the 17th. It took 47 hours to reach Adelaide, at a rate of 28 miles per hour, but, as will be seen by the graph, intensified considerably, the lowest reading, which occurred at 2.15 p.m., being 29·55 in. or 0·19 in. below that reached at Perth.

The rate of travel dropped to 16½ miles per hour between Adelaide and Melbourne, and the energy of the storm showed a marked increase; not only was the minimum pressure reading 0·18 inch lower than in South Australia, but the perturbations in the atmosphere recorded between 2 a.m. and midnight of 19th were indicative of unusual cyclonic activity, and also of the development of electrical phenomena, which features in combination assisted in bringing about the floods; the diminished rate of travel while over Victoria also favored greater precipitation by giving the storm a longer period in which to operate.

The rate of easterly progression to Hobart was 16 miles per hour, showing a slight reduction of speed as compared with its previous movements.

The curve of the southern capital shows fewer undulations than were noted at Melbourne, and a more gradual fall in pressure, but the subsequent rise after the passage of the centre was somewhat sharper than at any of the other places; moreover, the minimum barometer reading was over half-an-inch lower than any of the others recorded on the mainland.

There is nothing particularly remarkable in the Sydney curve, except that the time which elapsed between the passage of the north and south axis of the storm from Hobart to Sydney was under two hours, which fact denotes that the axis was inclined very slightly from the meridian. It is probable, therefore, that the change of wind from north to south, was experienced almost simultaneously along the coast line of New South Wales.

ANTECEDENT WEATHER.

It is evident that some unusual influences have been in operation during the present winter; but a review of the general Australian weather for the past few months throws little or no light upon the proximate cause of the abnormal conditions. Whatever their cause or origin may be, it is evident that the disturbing factors have had world-wide influence, as reports to hand show that, coincident with the storms and heavy rains in Australia, other parts of the globe have been similarly affected. In Java, in May, June, and July, continual rains fell (instead of the usual dry season); in India the winter rains were above the average; the English summer was marked by constant rain; and at the close of August an unparalleled snow storm visited the Transvaal; a record rain storm occurred in New York; and tremendous floods with unprecedented cold in Mexico.

In Australia the summer of 1908–9 set in hot in the sub-tropical parts, and some good monsoon rains fell in Queensland, but these conditions were not maintained, and the opening three months of the year were marked by cold, dry weather, generally over southern Australia (except February in New South Wales), and a general failure of the monsoon tropical rains. In southern Australia the westerly trade rains were late in starting, although in April precipitation was above the average over the western half of the continent and extended across south-west Queensland to the north-east corner of New South Wales and along the south coast line to Victoria and Tasmania; and it was not till May that a general break in the dry weather occurred over the south coast districts. From thence onwards to the period now under review there was no lack of moisture; indeed, in many parts of Victoria and South Australia the ground was so thoroughly soaked with the constant rains that all low-lying lands were flooded and agricultural operations suspended.

In sub-tropical Australia the mean temperatures were below normal in the autumn (especially in April) and in the winter, but in central and tropical Australia the winter was somewhat warmer than usual. At Adelaide it was the coldest April in the 52 years' records.

A fuller review of the Commonwealth weather conditions of the year to date is given in the following tables, which show, firstly, the mean temperatures for the summer, autumn, and winter months at selected stations in northern, central, and southern Australia; and, secondly, the amount (expressed in percentage of the normal) the mean rainfall in each district was above or below the normal for each month of the present year.

DEVIATION OF THE MEAN TEMPERATURE FROM THE NORMAL 1909.

—	Nov.	Dec.	Jan.	Feb.	Mch.	Five Summer Mos.	Apr.	May	Two Autumn Mos,	June	July	Aug.	Three Winter Mos.
	1908.	1908.	1909.	1909.	1909.	1909.	1909.	1909,	1909.	1909.	1909.	1909.	1909.
Northern Australia.													
Port Darwin..	0	−1.4	*+0.8*	*+1.0*	−0.8	−0.1	−1.4	−0.3	−0.8	*+1.3*	*+1.7*	*+1.7*	*+1.6*
Onslow ..	*+0.9*	*+1.1*	−2.4	−1.1	−1.4	−0.6	−3.9	−2.1	−3.0	*+0.8*	−1.1	−1.9	−0.7
Townsville ..	−1.9	−1.9	−1.6	−0.1	−2.1	−1.5	−0.1	*+0.9*	*+0.4*	−0.1	*+1.2*	*+5.8*	*+2.3*

Onslow.—April is the coldest in the 12 years' records.
Onslow.—January is the coldest in the 12 years' records.

—	Nov.	Dec.	Jan.	Feb.	Mch.	Five Summer Mos.	Apl.	May	Two Autumn Mos.	June	July	Aug.	Three Winter Mos.
	1908.	1908.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.
Mid-Latitudes of Australia.													
Alice Springs	−2.3	−1.4	−1.7	−2.0	*+1.8*	−1.1	0	*+0.6*	*+0.3*	*+1.7*	−1.9	*+1.5*	*+0.4*
Charlotte Waters	−0.9	0	−0.1	−2.3	*+0.3*	−0.6	−0.9	*+0.8*	0	*+1.1*	−2.2	*+1.9*	*+0.3*
Lawlers ..	*+0.9*	*+3.2*	−7.2	−2.4	*+0.9*	−0.9	−4.9	−1.4	−3.2	*+0.1*	−2.1	−1.2	−1.1
Brisbane ..	−0.4	*+1.3*	−1.4	−0.4	−0.3	−0.2	*+0.4*	*+0.7*	*+0.6*	*+1.9*	*+0.6*	*+1.1*	*+1.2*

Lawlers.—January is the coldest in the 11 years' records.

—	Nov.	Dec.	Jan.	Feb.	Mch.	Five Summer Mos.	Apl.	May	Two Autumn Mos.	June	July	Aug.	Three Winter Mos.
	1908.	1908.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909	1909.	1909.	1909.
Southern Australia.													
Perth ..	*+0.5*	*+1.2*	*+1.4*	*+1.5*	*0*	*+0.9*	−1.3	−0.5	−0.9	*+0.4*	−1.7	−0.4	−0.6
Eucla ..	0	*+2.4*	−1.2	−3.1	−1.9	−0.8	−2 1	−0.4	−1 2	−1.8	−2.4	−2.8	−2.3
Farina ..	*+1.2*	*+0.4*	−1 1	−4.2	−1.9	−1.1	−4.5	−1.4	−3.0	−0.3	−2.4	−0.8	−1.2
Adelaide ..	*+2.3*	*+2.1*	−1.2	−3.3	−0.9	−0.2	−4.9	−0.5	−2.7	−0.4	−1.7	−1.4	−1.2
Sydney ..	*+1.2*	*+2.1*	*+0 4*	−2.4	*+0.4*	*+0.3*	−1.5	−0.1	−0.8	*+1.0*	−1.4	−0.6	−0.3
Melbourne ..	*+3.5*	*+3 8*	−1.4	−0.2	*+0.4*	*+1.2*	−0.9	*+0.3*	−0.3	−0.3	−0.9	−1.1	−0.8
Hobart ..	*+2.4*	*+0.7*	−3.4	−2.3	*+0.8*	−0.4	−2.9	*+1.2*	−0.8	−1.2	−0.2	−2.2	−1.2

Perth.—July is the coldest in the 12 years' records.
Eucla.—July is the coldest in the 31 years' records.
Eucla.—February is the coldest in the 31 years' records.
Farina.—February is the coldest (but one) in the 20 years' records.
Farina.—April is the coldest in the 20 years' records.
Adelaide.—April is the coldest in the 52 years' records.

DEVIATION, ETC.—*continued.*

——	Nov.	Dec.	Jan.	Feb.	Mch.	Five Summer Mos.	Apl.	May	Two Autumn Mos.	June	July	Aug.	Three Winter Mos.
	1908.	1908.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.	1909.
Simla (India)	-0.5	-0.8	+*0.8*	+*0.2*	+*0.6*	+*0.1*	-2.4	-0.2	-1.3	-0.9	-0.9	+*0.2*	-0.5

TABLE showing percentage of deviation from Normal of Rains throughout Australia from January to August, 1909.

District.	Jan. 1909.	Feb. 1909.	Mch. 1909.	April. 1909.	May. 1909.	June. 1909.	July. 1909.	Aug. 1909.
Western Australia.								
East Kimberley	- 47	+ *45*	- 27	+*133*	-100	-100	-100	+*1300*
West Kimberley ..	- 72	- 31	- 73	+*223*	- 15	+ *20*	-100	- 100
North-west	+ *39*	- 80	- 93	+ *73*	- 47	+*272*	- 59	- 50
Gascoyne	+*650*	- 37	- 99	+*191*	- 31	+ *18*	- 57	+ *223*
South-west	+ *97*	- 42	+ *20*	+ *77*	+ *15*	+ *7*	- 31	+ *74*
Eucla	- 28	- 80	- 34	+*158*	+ *19*	+ *3*	+ *2*	+ *115*
Eastern	+*386*	- 72	- 70	+ *28*	- 46	+ *17*	- 38	+ *149*
South Australia.								
Northern Territory (U.)	- 23	- 30	- 29	+ *20*	- 55	-100	-100	+*1600*
Northern Territory (L.)	- 80	- 60	- 45	+ *41*	- 94	+ *86*	- 93	+ *240*
Far North and North-west	- 32	- 97	- 57	- 10	+*133*	+ *61*	- 13	+ *120*
Western	- 55	- 24	- 37	+ *4*	- 7	- 11	+ *14*	+ *114*
Upper North ..	- 58	- 69	- 62	- 19	+*127*	+*115*	+ *32*	+ *71*
North-east	- 51	- 60	- 4	- 57	+ *96*	+*128*	- 41	+ *15*
Lower North ..	- 13	- 47	- 66	- 10	+ *56*	+ *32*	+ *36*	+ *130*
Central	- 12	- 16	- 27	+ *52*	+ *64*	- 21	+ *53*	+ *105*
Murray Valley ..	- 25	- 57	- 32	- 7	+ *83*	- 4	+ *56*	+ *142*
South-east	- 20	- 21	+ *5*	+ *39*	+ *71*	+ *5*	+ *20*	+ *46*
Queensland.								
Peninsula	+ *25*	- 47	+ *58*	- 53	+*280*	+*279*	+*117*	+ 0
Carpentaria	- 53	- 58	+ *39*	- 66	- 83	+*183*	+ *28*	- 32
Western	- 71	- 58	+ *64*	+ *65*	- 91	+ *47*	-100	+ *546*
Central	+ *15*	- 65	- 55	- 3	- 92	+ *31*	- 4	+ *181*
North Coast ..	- 7	- 74	- 9	- 48	- 79	+ *2*	- 13	- 18
Central Coast ..	+ *11*	- 70	- 45	- 61	- 51	- 7	+ *64*	- 51
South Coast	- 18	- 46	- 61	+ *23*	- 73	- 8	+ *68*	+ *73*
Darling Downs ..	- 62	- 4	- 62	+ *35*	- 49	+ *10*	- 10	+ *82*
Maranoa	+ *4*	+ *28*	- 8	+ *5*	- 75	+*107*	- 32	+ *349*
South-west	- 38	- 10	- 8	- 17	- 80	+ *80*	- 72	+ *390*
New South Wales.								
Western (Upper) ..	- 51	+ *14*	- 48	- 25	- 42	+ *57*	- 64	+ *167*
Western (Lower) ..	- 85	+ *26*	- 33	- 59	+ *29*	+ *93*	- 62	+ *48*
North-west Plains ..	- 54	+ *93*	- 71	- 10	- 41	+*106*	- 36	+ *175*
North-west Slopes ..	- 60	+ *96*	- 84	+ *10*	- 52	+ *51*	- 41	+ *139*
Northern Tablelands ..	- 79	+ *51*	- 56	+ *21*	- 43	+ *1*	- 24	+ *88*
North Coast ..	- 76	- 31	- 32	+ *8*	- 77	- 47	- 29	- 49
Hunter and Manning	- 59	+ *5*	- 63	- 43	- 63	- 1	- 79	- 40
Central Tableland ..	- 1	+ *46*	- 80	- 50	- 44	+ *34*	- 62	- 5
Metropolitan ..	- 59	+ *67*	- 86	- 84	- 76	+ *1*	- 83	- 66
Central Western Slope	+ *3*	+ *87*	- 59	- 25	- 52	+ *55*	- 59	+ *78*
Central Western Plain	+ *45*	+ *71*	- 17	- 48	- 51	+ *74*	- 75	+ *142*
Riverina	- 55	+ *27*	- 25	- 14	+ *30*	+ *43*	- 38	+ *71*
South-west Slope ..	- 40	+ *76*	- 0	- 10	+ *14*	+ *48*	- 31	+ *72*
Southern Tableland ..	- 9	+ *73*	- 59	- 48	- 52	+ *69*	+ *5*	- 14
South Coast ..	- 28	+ *66*	- 88	- 88	- 75	+ *53*	- 21	- 62
Victoria.								
Gippsland	- 7	+ *35*	- 31	- 29	- 38	+ *81*	+ *44*	+ *23*
North-east	- 20	- 12	+ *40*	+ *75*	+ *44*	+ *56*	+ *3*	+ *72*
Central	+ *23*	- 2	- 26	+ *13*	- 1	+ *29*	- 15	+ *117*
North Central ..	+ *11*	+ *26*	- 2	+ *14*	+ *96*	+ *5*	- 1	+ *153*
Northern	- 21	+ *21*	- 12	+ *13*	+ *81*	+ *16*	+ *20*	+ *109*
Mallee	- 9	- 23	+ *9*	- 7	+*127*	+ *43*	+ *47*	+ *125*
Wimmera	+ *7*	- 33	+ *28*	- 4	+ *41*	+ *41*	+ *34*	+ *155*
Western	+ *4*	- 28	+ *9*	+ *32*	+ *27*	+ *49*	- 14	+ *74*
Tasmania.								
Northern	- 12	- 38	+ *33*	+ *70*	+ *14*	- 12	- 18	+ *75*
West Coast	- 23	- 61	+ *71*	+ *94*	+ *9*	- 3	- 40	+ *35*
Central Plateau ..	+ *56*	+*103*	..	- 26	+ *3*	- 4	- 67	- 16
Midland	+ *93*	- 36	- 42	+ *82*	+ *3*	+ *35*	- 34	+ *66*
East Coast	+ *19*	+ *1*	+ *28*	+ *35*	+ *40*	+ *46*	- 15	+ *24*
Derwent	+ *10*	- 54	+ *45*	+ *55*	+ *12*	+ *69*	- 80	+ *68*
South-east	- 3	- 22	+ *2*	+*185*	+ *16*	+ *74*	- 18	+ *63*

SECTION II.

Although the series of storms discussed in the foregoing pages operated most severely in Victoria, yet parts of New South Wales and South Australia were also considerably affected by flood waters. In South Australia the districts mainly affected were the southern hills and adjacent plains and the south-east, and in New South Wales the valley of the Murrumbidgee. In South Australia, though considerable damage is done by flooded water-courses, creeks, and rivers, floods over low-lying lands seldom reach the danger limit, and really cause but temporary inconvenience and mean a great addition to the fertility of the soil. Diagrams of the heights reached at several river gauges, showing comparisons with previous records, and the areas more or less affected by the flood waters, are included as an appendix to this section.

HEIGHTS REACHED BY FLOOD WATERS.

The diagram showing heights reached by flood waters during August and September gives the dates and highest points the waters on the Lachlan, Murrumbidgee, Edward, Ovens, Goulburn, and Murray reached on the different river gauges, and also the relation of those heights to the flood levels and the levels of the highest recorded flood readings.

It will be observed that the flood waters were well over the banks at all recording stations on the Murrumbidgee and Murray rivers, with the exception of Albury, Gundagai, and Moulamein, and also that no new record was established, the majority of the heights during the recent flood being several feet below previous levels attained in former years. It is doubtful, however, whether during former flood experiences the area affected simultaneously has ever been so extensive as during this season.

THE GREAT FLOOD RAINS IN VICTORIA, 18TH–19TH AUGUST, 1909.

The series of heavy rains, accompanied by violent and prolonged thunderstorms, which set in over the western parts of the State in the early morning of 19th August, gradually extended eastwards during that day, and was responsible for phenomenal floods in almost all the rivers in the western half of the State. These rains appear to have been at their greatest intensity along two parallel lines, one joining Warracknabeal and Queenscliff, the other Glenalbyn and Kyneton, and these give pretty nearly the direction in which the storm clouds were observed to be moving during the fifteen to twenty hours within which almost all the rain fell. East of Kyneton the rains lost their extraordinary character, but falls of over 1 inch were still the rule in all except the plains or country of relatively low level stretching from Echuca to Albury, and including Benalla, while in the more mountainous country the falls were generally between 1 and 2 inches. In Gippsland, owing to the mountain barrier to the north and west, the rainfall was generally insignificant, and actually nil around and east of the Lakes. The heaviest totals, above 4 inches, were received along a narrow strip of high country following the crest of the Dividing Range westward from Kyneton, and probably including the Pyrenees. The area over which amounts exceeding 3 inches were recorded included all the highlands west from about Lancefield, practically the whole drainage area of the Wimmera, Avon, and Richardson, Avoca, Loddon, and Campaspe rivers in the North side, the Barwon and Moorabool in the south side, as well as the head waters of the Saltwater, Hopkins, Glenelg, and Wannon rivers. The area in which over 2 inches fell may be roughly outlined by a line joining Dunkeld, Goroke, Beulah, Charlton, Elmore, Sunbury, Apollo Bay, and Wickliffe. The rain seem to have occupied generally about nineteen or twenty hours. At Donald it began at 11 p.m. on the 18th, and ended at 6 p.m. on the 19th, and at Kyneton it began at 2 a.m. on the 19th, and ended, so far as the very heavy rain was concerned, about 8 p.m. It is of importance to note, too, that all over the watershed, from the Grampians to Mount Macedon, the heaviest downpour of rain took place during the last hour, as the result of a great thunderstorm, ending at 6 p.m. in the western portion, and about 8 p.m. at Macedon. At Trawalla no less than 142 points fell during this last hour, in that case from 5 to 6 p.m. A short account of the way in which the chief rivers were affected may be of value. The information on which it is based is mainly due to the courtesy of voluntary observers for the Meteorological Bureau, who, in reply to inquiries, have supplied very full information. In many cases the engineers for the shires have kindly given definite details.

WIMMERA.

The gathering ground for the flood waters of this stream has an area of about 1,900 square miles, and the average fall of rain over it during the nineteen hours ending 6 p.m., 19th August, was about 3¼ inches.

At Elmhurst, a small town at the foot of Mount Cole, the range in which the Wimmera has its source, the flood was at its maximum at about 9 p.m. on the 19th, the final and heaviest of the thunderstorm rains occurring between 5 and 6 p.m. Mr. J. Wise, of this town, stated that the flood reached a point on the town bridge 2 feet higher than that of 1870, in spite of the fact that the destruction of timber along the river has caused it to greatly widen and deepen its channel since that year. This would imply a very much larger volume for this flood than for that of 1870, and this is supported by evidence from Eversley, a place 5 miles lower down the stream, where this flood was 3 feet higher than that of 1870, as measured in a garden situated near the river.

Some 50 miles lower down the river is the town of Glenorchy. This place was very severely flooded, only six houses escaping inundation. The maximum there was reached about 1 a.m. on the 21st.

After travelling about 40 miles further down the river, Horsham is reached. The crest arrived here about 2.30 a.m. on the 22nd, and gave a maximum depth of 11 ft. 8 in., as measured by the weir gauge, the previous highest record being 10 ft. 10 in., on 9th October, 1890, and 10 ft. 3 in., on 15th June, 1889. No similar gauging was possible in 1870, but Mr. J. Langlands, who has noted on the wall of a brick house the heights of all the great floods, says that this flood was practically identical in volume with those of 1870 and 1852.

Dimboola, which is about 40 miles further down, was said to have been reached at 3 a.m. on the 23rd, or 24½ hours later. The maximum height, as registered at the weir there, was 13 ft. 7 in., and the highest previously recorded 10 ft. 2 in. This, however, is for seven years, the weir not having been in existence much longer than that time. In the engine shed of the pumping station the height of the flood of October, 1894, was noted, and was 4 inches below the last one. There are no records of the flood of 1870.

At Jeparit, a small town almost opposite the point of discharge into Lake Hindmarsh, and about 30 miles lower down from Dimboola, the flood waters were 16 feet above the weir, and 2 feet above the flood of 1894, which was the highest previously noted. There is here no record of 1870. The flood was at its maximum about 9 p.m. on the 25th. By the 2nd September Lake Hindmarsh was overflowing into Lake Albacutya by means of Outlet Creek. On the 14th a strong stream was still flowing into the lake, and the flood waters were backed up about Jeparit, some roads being still under water. At the time of the maximum, only about 200 acres of comparatively high ground in this village escaped flooding, the remaining country being submerged for miles in every direction.

The Wimmera has two effluent streams, both flowing due north. The first is the Dunmunkle Creek, which begins its separate existence a little above Glenorchy, and flows past Rupanyup. At this place the water was said to have been 4 ft. 6 in. deep over the whole of the township and flowing in a stream 3 miles in width at 4 a.m. on the 21st, when the flood was at its maximum.

The next is the Yarriambiack, which leaves the Wimmera above Longerenong and flows past Warracknabeal and Beulah. At the former, which is some 35 miles from the offtake, no flood records are kept, but on this occasion it was noted that the waters just touched the wall of the Shire Hall building at the corner of Scott and Phillip streets, which no previous flood was ever known to do. This was between 2.30 p.m. and 4 p.m. on the 22nd. It was thought that road and street formation and railway construction might have had some effect in diverting the flow of the water.

At Beulah, 25 miles further north, no flood records have been kept, but local residents think the flood of 1889 was slightly higher, for in that year certain swampy depressions were filled by the overflow, which were not affected this year. The flood was at its highest here about 10 a.m. on the 24th. This town was only saved by hastily-built levees. On the 30th Lakes Coorong and Lascelles were filled, and a large stream of water continued its course northwards into various Mallee swamps and depressions. The "Two Mile" railway bridge was covered to a depth of 4 inches, and traffic was stopped for the time.

THE AVON AND RICHARDSON.

The area of this basin is about 720 square miles, and, although a portion of the Avon basin only is really hilly, it is probable that on this occasion the percentage of run-off was very large, the ground being already saturated, and an average of quite 3½ inches falling over the whole area.

The flood reached Donald on the 20th, and at 11.30 p.m. on that date was within 6 inches of the wooden girders of the railway bridge over the Richardson River at its south end (nearest the railway station). At the corner of Wood and Hammerill streets the flood mark was 369.49 feet above sea level, as determined by Mr. Thomsen, an engineer of the State Rivers and Water Supply Commission. A great extent of the surrounding country was flooded, and a good part of the town itself—all Wood-street being under water. No flood since 1870 came within 4 or 5 feet of this one. There is no record of the 1870 flood except what was observed by old residents. These say that the heights of the two floods were about the same. It is thought that the effect of the railway embankment was to make the flood a little higher than that of 1870 in Donald itself, but slightly lower further down.

THE AVOCA.

The drainage area of this stream is between 1,100 and 1,200 square miles, but it is a long and narrow strip of country, so that, as a rule, at points down stream, the flood waters from all sources might not be expected to arrive together.

At Avoca, a town about 15 miles from the source of the river, the maximum height was reached at about 9.45 p.m. on the 19th, and, as shown on a post erected near the bridge, was 8 inches below that of November, 1870. No other flood approached these in height except that of October, 1870. The river has silted up considerably in recent years, and a great deal of timber has been removed from its banks—two factors which will, of course, make it difficult to make proper comparisons with the past.

The effects produced by erosion due to the clearing of the country are noted at Natte Yallock, a village some 10 miles further down the stream. The flood waters there are said to get away much more quickly than formerly owing to the excavation, by successive floods, of a channel through a swamp, where formerly the river used almost to lose itself. As the flood below Natte Yallock was said to have been 6 miles in width, it was probably this swampy land which was referred to. At this station the flood was at its highest about 11 p.m. on the 19th, and almost the same height as in 1889; but no definite records of previous floods are available here.

At Coonooer, 40 miles lower down, only the top of the bridge was visible, and the river attained a width of 3 miles. The records of floods since 1878 are here noted on the walls of a barn near the river. According to this the flood of 1878 held the record until the arrival of this one, which exceeded it to the enormous depth of 39 inches. The flood crest arrived here about noon on the 20th, and the waters were falling decidedly within an hour afterwards.

Charlton, 16 miles further down, was reached between 7 and 9.30 p.m. on the 20th, and from reports of the degree of submersion of the floors of the houses there seems to be no doubt that this flood was at least 6 to 8 inches above the next highest, that of 1870, and 4 feet above any other since that time. The South African monument, opposite the Mechanics' Institute, is being utilized to record the heights of this and the exceptional floods of the future. To what extent the railway embankment may be responsible for the excessive height of the waters in this town—the main street being flooded to a depth of from 1 to 4 feet—is uncertain, but it is thought that it dammed up the waters very considerably.

On the 24th inst., Quambatook, a place about 35 miles below Charlton, was flooded to a depth of 1 foot in the streets.

Twenty-five miles further on the Avoca ends its course in a small lake—Bael Bael. At this point no very definite information was obtainable, but the impression of the residents there is that this flood was not equal to that of 1870, as there are some old lake beds in the Mallee which were filled in that year but not in this. The waters were highest here on the 25th and 26th of the month.

A great overflow from below Charlton took place towards Boort, filling Lake Marmal and causing it to overflow for the first time in 39 years. The observer there says that there is no reliable information of previous floods, but there is no doubt that the lake has more water in it now than was ever known before. The general impression is, however, that the 1870 flood was quite as high. The sand drifts of 1902 have altered the flow of water to some extent.

Tyrrell Creek is an effluent stream from the Avoca, which in flood-time diverts a considerable proportion of the flow in a north-westerly direction, and after traversing a distance of about 70 or 80 miles ends in Lake Tyrrell. This stream flooded Wycheproof. There the flood was said to be 5 feet above any experienced since 1870, and, according to an old resident, was higher even than in that year. The maximum was reached at 11 a.m. on 22nd August. A swamp south of the town was filled owing to the waters being diverted in a considerable quantity by the railway embankment.

At Kaneira, the flood was over the gravel beam on the shire bridge at Tyrrell Creek, a greater height than any previously known. There is no record of 1870. Here the time of maximum was about 2.20 p.m. on the 22nd.

THE LODDON.

The rainfall of 19th–20th August over the drainage area of this river, which is about 2,230 square miles, or twice that of the Avoca, averaged about 320 points. This river, owing to the way its tributaries converge and meet at nearly the same point after travelling equal distances is, perhaps, more liable to sudden and heavy floods than almost any other stream of the same size in Victoria. Two serious disasters occurred as the result of this one. The earthworks flanking Laanecoorie Weir, which is situated just below the point where the Loddon is joined by its principal tributary streams, the Deep Creek and the Bet Bet, gave way at 1 a.m. on the 20th, and the railway bridge over McCallum Creek, between Clunes and Talbot, collapsed at 8 p.m. on the 19th, just before the crossing of a train.

At Lexton, a village 4 or 5 miles from the source of the Bet Bet Creek, the rains totalled 3½ inches, the heaviest of which fell in a great thunderstorm about 5.30 p.m. on the 19th, and the flood occurred half-an-hour later.

Joyce's Creek was heavily flooded all the afternoon of the 19th, the maximum at Campbelltown being at 3.30 p.m., when it surpassed all other records, even the flood of 1870 having to take second place with a maximum height, probably, quite 2 feet lower, as indicated on the bridges. At 10 p.m. another rush of flood waters raised the level of the stream to within 8 or 10 inches of its former height.

At Clunes, which is 15 or 16 miles from the source of Creswick Creek, the water just reached the bottom of the new bridge (iron girders) in Bailey-street, giving a height 2 feet above any other known flood. There is, however, no record of the 1870 flood, which is rather a strange thing for a town so long established. This flood is considered by old residents to be greater. Here the strongest flow was from 11.30 a.m. to 2.30 p.m. on the 19th, a very heavy rain storm having given 106 points between 9 a.m. and 11.30 a.m. Mr. Sando, C.E., who supplied the foregoing, mentioned, as an interesting fact, that the bed of the creek is now, for the first time in forty years, becoming visible. The local mining companies ceased work twelve years ago, and the stream, aided by occasional floods, has taken that time to clear itself from the gravel and sludge deposited in it as the result of mining operations.

Newstead is a town on the Loddon about 30 miles from its source, and the same distance from Laanecoorie Weir. Here, too, there is no record of the 1870 flood, but in more recent years the heights of great floods have been noted on the old shire hall opposite the post-office. The flood of 1889 was the highest until this one, which, at about 11 p.m. on the 19th, exceeded it by 25 inches. The shire engineer, who supplied the information, remarked that no changes affecting flood waters have been made within recent years. At this station rain fell heavily off and on all day on the 19th, but was especially heavy during a thunderstorm, lasting from about 6.30 to 8 p.m.

Mr. McCracken, of Laanecoorie Weir, remarked that there will be no lack of permanent records of this flood, marks having been made everywhere on trees and houses in Laanecoorie and Newbridge to commemorate it. There are no records of the 1870 flood, but people for 9 miles round are unanimous that this flood was from 3½ to 4 feet above it. The maximum recorded was about 1 a.m. on the 21st, when the weir collapsed. The previous highest flood noted at the weir was on 22nd and 23rd June, 1899, when 22 ft. 6 in. was discharging, but on this occasion the gauge showed 36 feet! The weir was built in 1889.

Mr. Howie, of Memsie Estate, noted the height on his front verandah posts, and on the dome of the underground tank, and says that no previous flood was within several feet of the present one. He has no record of 1870. The time of maximum height there was between noon and 1 p.m. on the 20th.

In Mr. Samer's hotel in Bridgewater the water was over the counter, and estimated to be higher by 18 inches than the flood of 1870. The great height reached was thought to be partly due to the breaking of the weir and damming back by the railway embankment, but to what extent is quite uncertain.

At Boort on the 22nd the stream was said to have been 15 miles wide, and by the 25th Woolshed Lake was filling for the first time in 35 years. Reports from Kerang indicated that the flood had reached its maximum, and was perceptibly falling by 4 p.m. on the 24th. Levees had been built to save the town from inundation, but without success.

Enormous quantities of water found their way from the Loddon into the Murray for many miles above the ordinary junction of the two rivers. A large volume of water on the 21st swept down Pyramid Creek—an effluent of the Loddon. This was attributed by many to the breaking away of the Laanecoorie Weir, and was said to have been quite 6 miles in width. At all events, Mitiamo and Mologa were reported to have been flooded in parts to depths of 7 feet, with disastrous results to any houses the walls of which were composed of mud bricks.

At Pryamid Hill the flood was so high that the tops of the posts, 4 ft. 3 in. in height, around the town reservoirs were just visible. This was about 1 a.m. on the 22nd. The township has never been flooded before, but it is only 25 years old. There is no record of the flood of 1870. The exceptional height of this flood is attributed locally to the breaking away of the Laanecoorie Weir.

THE CAMPASPE.

The drainage area of this stream is about 1,270 square miles. The flood rains appear to have been of about the same amount and intensity as over the basins of the rivers further west, but were exceptionally heavy at its source and that of the tributary stream—the Coliban, Kyneton, recording 460 points, and Daylesford 426.

At Kyneton, which is about 16 miles from the source of the Campaspe, flood marks have been cut on the north abutment of Mollison-street bridge. According to these, the flood this year completely surpassed any previous one. The height of the 1870 flood was noted on the ironwork of the valve-frame at the pumping station at Mollison-street bridge, and, according to that, it was actually 4 feet below the level of the August flood this year. The maximum was at 11 p.m. on the 19th. The heavy rains began in Kyneton about 2. a.m. and continued off and on until midnight, but were heaviest from 7 to 8 p.m.

The observer at Trentham, a town almost at the top of the Coliban watershed, where 4¾ inches fell, says that the flood there was the highest for at least twenty years, and was at its maximum by 10 p.m. on the 19th. He has no records of 1870. On the tower at the Upper Coliban reservoir, 10 or 11 miles below Trentham, the gauging staff reads 53 ft. 6 in. when the reservoir is full. On this occasion—1 a.m., 20th August—it read 56 ft. 10 in., the highest previously noted being 56 ft. 3 in. on 8th September, 1906. The caretaker reported rain all day till 4 p.m., when heavy thunderstorms set in and lasted till 8 p.m., the rain registration for the eleven hours being nearly 3 inches, and from the time the rain first began to fall heavily, probably at about 2 a.m., 380 points. This reservoir was completed in 1902.

At Rochester, a town about 90 miles below Kyneton and 60 miles below the junction of the Campaspe and Coliban, the height was noted on a gauge fixed on the railway bridge 1½ miles north of Rochester as 28 ft. 11½ in. This was at 4 a.m. 20th August. On the 10th September, 1906, the reading was 29 ft. 6 in., and on 23rd June, 1899, 28 ft. 5 in., the last-mentioned being the highest for the preceding 26 years, as shown by a diary kept by Messrs. Hart and Creswell. There is here no record of the flood of 1870, but some old residents say that the flood of 1906 exceeded it by nearly 1 foot. It is the intention of the shire council to erect a gauge in the river as soon as it can be done.

About 20 miles further on the Campaspe flows into the Murray at Echuca. The flood was at its highest here at 6 a.m. on the 21st.

THE GOULBURN.

This is much the largest of the Victorian feeders of the Murray River, having an effective drainage area of about 6,400 square miles, nearly all of which is very mountainous, with a comparatively heavy average rainfall. On this occasion the rains were not very heavy, averaging probably only about 140 points, and were spread pretty well over the three days, but the rivers were already very high, and this was sufficient to noticeably increase their flow, and, in the case of the main stream, cause it at various points to burst through the levees built to restrain it. The maximum height officially reported at Shepparton was 33 feet on the morning of the 23rd, or 3 feet below the flood of 1870. At Murchison it reached its maximum at noon on the 22nd, where also the record was 33 feet. In September, 1906, at this point it was 1 ft. 6 in. higher, or 34 ft. 6 in. according to the present gauge. The level at Shepparton was very high all this month, never being below 29 feet. At Seymour a sudden and heavy flood occurred on the 20th, when the gauge showed a height of 19 ft. 6 in. From the tables supplied below, it will be seen that at Murchison the floods of 1909 have been exceeded several times within the last 29 years, more especially in November, 1887, when the old gauge read 34 ft. 2 in., or in terms of the new gauge, 35 ft. 2 in.

THE OVENS.

This and the remaining tributaries of the Murray River drain the most mountainous portion of Victoria, where the rainfall is consistently heavy, and where also on the numerous high plateaux and mountain peaks considerable storages in the form of winter snows, which do not melt until early in summer, secure a volume and regularity of flow not characteristic of the western streams. As in the case of the Goulburn, while the rains on this occasion were considerable, they were not at all exceptional in quantity or intensity for this region, and did not do more than maintain the already high river levels. The Ovens was very high all the month, being always more than 11 feet above summer level at Wangaratta, and reaching its maximum for the month—15 ft. 6 in.—on the 14th.

THE MURRAY.

As on the Goulburn, a high level was maintained all the month. The gaugings at Echuca showed a steady rise of 23 ft. 6 in. on the 1st to 32 ft. 2 in. on the 22nd, after which there was a slight fall. The level appears to have only twice been exceeded during the last 42 years, namely, in October, 1867, when the gauging staff showed 35 feet, and in 1870, when the height was 38 ft. 9in., or 6 ft. 7 in. above the present one. At Tocumwal the difference was less, the 1870 reading being 20 ft. 10 in., and that of 21st and 28th August, 1909, 19 ft. 5 in. By the 30th considerable damage was done to crops, &c., below Echuca, Pental Island, and the country about Benjeroop and Lake Boga being badly flooded in spite of the formation of levees.

Of the southern rivers only those west from Melbourne were severely flooded, the diminution of the rainfall from this point eastward being very striking on the southern slopes of the Alps. This was due to two causes, (1) a change in the character of the disturbance itself, such that great thunderstorms similar to those which had raged in the west were not produced east of the 145th meridian, (2) the shelter afforded by the mountainous country of eastern Victoria, and more especially the Australian Alps.

THE SALTWATER RIVER.

The flood heights of this river only appear to be noted with any degree of certainty at Maribyrnong-bridge. There the river was at its greatest height on this occasion at 5 a.m. on the 20th, when it was said to have been 11 feet above normal. This was quite 4 feet below the flood of September, 1906, which completely surpassed anything ever known before.

THE BARWON.

This was the only southern river which had a rainfall over its drainage areas equal to that on the north side of the Dividing Range. It is even probable that the average fall was greater, for over almost all the plateau country drained by its tributaries, the Moorabool and Yarrowee, the rainfall exceeded 3 inches, and was well over 4 in many places; while over the slopes of Cape Otway Ranges, drained by the Barwon itself, the rainfall varied between 3 and 4 inches.

In this area at least four deaths were caused by drowning, two near Ballarat and two near Winchelsea. Queen's-bridge, near Geelong, was washed away on the 20th, and various soap works, tanneries, &c., near the river were badly damaged. The maximum height was reached at Geelong about 6 p.m. on the 20th, when it rose to a height of 3 ft. 9 in. on the walls of the Albion Woollen Mills. This was, however, much below the flood of 12th September, 1880, when in the same way a height of 7 feet was registered. Three factors are supposed to have been operative in keeping down the level of this flood as compared with that of 1880—(1) the removal of the railway embankment; (2) northerly winds during this flood as against east winds during the flood of 1880, the former accelerating the flow of the waters and the latter retarding it; (3) a low tide at the mouth of the river this year as against a high tide in 1880, which, of course, in a tidal stream would have a very great influence. Of the 1870 flood there is no record available.

At Shelford, a village on the Yarrowee, about 10 miles above its junction with the Barwon, and 40 below Ballarat, the flood was reported as being 3 feet higher than any previously noted. This was about 4.30 a.m. on the 20th.

THE HOPKINS.

Over the elevated plain country stretching from Ballarat to Ararat, most of which is drained by the Hopkins and its tributaries, Fiery and Mt. Emu Creeks, the rainfall was very heavy, always well over 3 inches, and actually 4 inches at Trawalla; and the floods were said to have been tremendous, bridges and culverts being extensively destroyed and train service dislocated, more especially on the Ararat to Hamilton line. At Beaufort no such floods were known for 40 years.

At Trawalla, about 12 miles from the source of Mt. Emu Creek, Admiral Bridges has had the heights of this flood at the homestead marked by pegs in the ground. Though no previous records of past floods have been made here, it is pretty certainly known that the flood of October, 1894, was 2 feet lower than this one, and that of 1870 about the same height. This flood was here made exceptional by the rains culminating in a terrific thunderstorm, which gave, between 5 and 6 p.m. on the 19th, no less than 142 points.

Skipton is about 35 miles further down Mt. Emu Creek. There the flood at 11 a.m. on the 20th was over the top of the bridge on Mt. Emu Creek. That of 1870 was about the same height.

At Hexham Park, about 90 miles from the source of the Hopkins, the height of this flood has been indicated by pegs driven into the banks. There are no permanent records made of other floods, but it is known that this one was below the levels reached in 1870, and also in 1894, in the latter case by 1 foot. The time of maximum here was 1 a.m. on the 21st.

The effect of the clearing and draining of the country in enabling flood waters to accumulate and get away more quickly than formerly has been commented on by all the observers who have reported on the floods in this river basin.

A newspaper report stated that at Warrnambool the flood was at its height early on the morning of the 22nd, and the river mouth scoured to three times its former width.

The Glenelg and Wannon floods were high, but not equal to the flood of 1906. At Harrow the difference was given as 12½ inches at 9 p.m. on the 20th. Casterton was flooded early on the morning of the 21st. The river was there half-a-mile wide, and flooded Holme's flour mills.

It is interesting to note that, when comparing the great floods of September, October, and November, 1870, with those in August this year, the general impression of observers near the sources of the rivers west from the Goulburn is that the flood of August, 1909, was much heavier than any in 1870; but on the lower reaches, where the comparison depends mainly upon the number of swamps and lake beds filled, the reverse appears to be the case. A comparison of the few rainfall records available in 1870, with corresponding ones this year, tends to harmonize these apparently conflicting statements. In the former year a wet January was followed by an almost rainless February and March, but good rains fell in April and May, and the next five months were extremely wet. For the five months, June to October inclusive, the totals were 19.76 inches at Stawell, 18.49 at Ararat, 23.85 at Ballarat, and 33.92 at Daylesford. For the same period this year the totals were 14.73 for Stawell, 17.29 for Ararat, 15.63 for Ballarat, and 21.28 for Daylesford. But the rainfall for the month of August, 1909, was in each case well in excess of that for any month in 1870, and the rain which fell so generally during the 19th August, 1909, was far beyond any single day's rain in 1870, that is so far as these stations are concerned. Hence it may be safely assumed that near the sources of the rivers the volume of water on the night of the 19th August, 1909, was considerably greater than at any time in 1870, but that in the former year the total winter discharge of all streams was much greater than in 1909, from which it follows that the great spring floods of 1870 probably overflowed a much greater extent of low-lying plain country, and filled many more swamps and old lake beds than were filled this year.

River.	Towns on Banks.	Distances from source (approximate).	Time of Maximum.	Heights reached.
		Miles.		
Wimmera	Elmhurst	10	9 p.m., 19th Aug.	2 feet above that of 1870
,,	Glenorchy	60	1 a.m., 21st Aug.	
,,	Horsham	100	2.30 a.m., 22nd Aug.	11 ft. 8 in. on weir gauge
,,	Dimboola	140	3 a.m., 23rd Aug.	13 ft. 7 in. on weir gauge
,,	Jeparit	170	9 p.m., 25th Aug.	16 feet on weir gauge
Dunmunkle Creek	Rupanyup	82	4 a.m., 21st Aug.	4 ft. 6 in. deep in township
Yarriambiack	Warracknabeal	115	3 p.m., 22nd Aug.	Touched wall of shire hall
,,	Beulah	140	10 a.m., 24th Aug.	Slightly below flood of 1889
Avon and Richardson	Donald	60	11.30 p.m., 20th Aug.	6 inches below wooden girders, south end of railway bridge = 1870
Avoca	Avoca	15	9.45 p.m., 19th Aug.	8 inches below that of November, 1870
,,	Natte Yallock	25	11 p.m., 19th Aug.	
,,	Coonooer	65	noon, 20th Aug.	39 inches above flood of 1878
,,	Charlton	81	8.30 p.m., 20th Aug.	6 to 8 inches above 1870; 4 feet above any other
,,	Quambatook	116	24th Aug.	
,,	Bael Bael	139	25th and 26th Aug.	Below that of 1870
Tyrrell Creek	Wycheproof	100	11 a.m., 22nd Aug.	Above that of 1870
,,	Kaneira	130	2.20 p.m., 22nd Aug.	Over gravel beam, shire bridge
Loddon and tributaries	Lexton (Bet Bet)	5	6 p.m., 19th Aug.	
,, ,,	Campbelltown (Joyce's Creek)	11	3.30 p.m., 19th Aug.	2 feet above 1870
,, ,,	Clunes (Creswick Creek)	16	11.30 a.m. to 2.30 p.m., 19th Aug.	Above 1870; touched iron girders of new bridge
,, ,,	Newstead	30	11 p.m., 19th Aug.	2 feet above flood of 1889
,, ,,	Laanecoorie	60	1 a.m., 20th Aug.	36 feet; weir gauge
,, ,,	Kerang	150	2 p.m., 24th Aug.	
Pyramid Creek	Pyramid Hill	..	1 a.m., 22nd Aug.	Tops of posts round town reservoir
Campaspe and Coliban	Kyneton	16	11 p.m., 19th Aug.	4 feet above 1870
,, ,,	Rochester	110	4 a.m., 20th Aug.	28 ft. 11 in. on gauge at railway bridge
,, ,,	Echuca	130	6 a.m., 21st Aug.	
,, ,,	Trentham	4	10 p.m., 19th Aug.	
,, ,,	Upper Coliban Reservoir	15	1 a.m., 20th Aug.	56 ft 10 in. = 3 ft. 4 in. above full reservoir level
Saltwater	Maribyrnong Bridge	85	5 a.m., 20th Aug.	11 feet above normal
Barwon	Geelong	70 miles from all sources	6 p.m., 20th Aug.	45 inches on walls Albion Woollen Mills
Hopkins and Mt. Emu Creek	Trawalla	12	Midnight, 19th	Same as 1870
,, ,,	Skipton	45	11 a.m., 20th Aug.	Same as 1870; over top of bridge
,, ,,	Hexham Park	90	1 a.m., 21st Aug.	Below 1870 and 1894
,, ,,	Warrnambool	140	Early a.m., 22nd Aug.	

GOULBURN RIVER.

Greatest Heights exceeding 26 Feet on Gauge Staff at Murchison, from June, 1881, *to August,* 1909, *with Dates of Occurrence.*

1881.
Aug.
26 ft. 9 in.

1883.
Aug.
31 ft. 9 in.
Sept.
26 ft. 6 in.
Oct.
31 ft. 9 in.
Nov.
27 ft. 6 in.

1885.
Sept.
31 ft. 3 in.
Oct.
28 ft. 8 in.

1887.
July.
27 ft. 3 in.
Aug.
33 ft. 0 in.
Sept.
30 ft. 9 in.
Oct.
26 ft. 3 in.
Nov.
34 ft. 2 in.

1889.
June.
31 ft. 9 in.
July.
31 ft. 0 in.
Aug.
28 ft. 6 in.
Sept.
33 ft. 9 in.

1890.
June.
26 ft. 10 in.
July.
26 ft. 10 in.
Aug.
27 ft. 0 in.
Oct.
28 ft. 11 in.

1891.
July.
32 ft. 3 in.

1892.
Sept.
27 ft. 9 in.

1893.
June.
26 ft. 6 in.
July.
30 ft. 10 in.
Sept.
31 ft. 5 in.
Oct.
29 ft. 9 in.

1894.
July.
32 ft. 3 in.
Aug.
30 ft. 11 in.
Sept.
32 ft. 9 in.
Oct.
32 ft. 0 in.

1895.
Sept.
29 ft. 9 in.

1897.
Sept.
31 ft. 6 in.

1899.
June.
31 ft. 9 in.
July.
28 ft. 0 in.
Aug.
26 ft. 3 in.

1900.
Aug.
30 ft. 6 in.

1901.
June.
27 ft. 3 in.
Sept.
26 ft. 8 in.

1903.
July.
27 ft. 6 in.

1904.
July.
29 ft. 3 in.
Sept.
29 ft. 0 in.

1905.
July.
31 ft. 0 in.
Aug.
30 ft. 0 in.

1906.
June.
31 ft. 0 in.
July.
31 ft. 9 in.
Aug.
28 ft. 0 in.
Sept.
33 ft. 6 in.
Oct.
33 ft. 1 in.

1909.
New Staff.*
May.
29.50 ft.
June.
32.50 ft.
Aug.
33 ft. 40 in.

Shepparton.
23rd Aug.
9 a.m.
1909.
33 ft. 0 in.

**Note.*—Zero of gauge staff altered to 1.00 lower; 26 ft. on old staff reads 27.00 on new decimally divided staff.

MURRAY RIVER.

Greatest Heights exceeding 26 Feet on Gauge Staff at Echuca from 1865 *to* 1908, *with Dates of Occurrence.*

1867.
Sept.
30 ft. 6 in.
Oct.
35 ft. 0 in.
Nov.
29 ft. 8 in.

1870.
Sept.
38 ft. 9 in.

1871.
Oct.
28 ft. 6 in.

1872.
July.
29 ft. 2 in.
Aug.
27 ft. 10 in.
Oct.
29 ft. 6 in.
Nov.
28 ft. 8 in.

1874.
July.
26 ft. 6 in.
Aug.
26 ft. 2 in.

1875.
June.
28 ft. 6 in.
July.
30 ft. 0 in.
Aug.
27 ft. 10 in.
Sept.
30 ft. 7 in.
Oct.
28 ft. 11 in.

1880.
July.
26 ft. 4 in.

1880.
Sept.
27 ft. 3 in.
Oct.
27 ft. 1 in.

1887.
Aug.
30 ft. 4 in.
Sept.
28 ft. 10 in.
Oct.
28 ft. 10 in.
Nov.
30 ft. 1 in.
Dec.
27 ft. 3 in.

MURRAY RIVER—*continued.*

1889.
June.
30 ft. 3 in.
July.
30 ft. 9 in.
Aug.
27 ft. 4 in.
Sept.
32 ft. 0 in.
Oct.
30 ft. 4 in.

1890.
July.
26 ft. 6 in.
Aug.
28 ft. 0 in.
Sept.
27 ft. 10½ in.
Oct.
26 ft. 7 in.
Nov.
26 ft. 9 in.

1891.
July.
28 ft. 5 in.
Aug.
27 ft. 3 in.

1893.
Aug.
27 ft. 8 in.
Sept.
26 ft. 6 in.
Oct.
29 ft. 9 in.
Nov.
26 ft. 11 in.

1894.
July.
28 ft. 5 in.
Aug.
30 ft. 3 in.
Sept.
31 ft. 4 in.

1894.
Oct.
30 ft. 6 in.
Nov.
30 ft. 5 in.

1900.
Sept.
26 ft. 5 in.

1905.
Aug.
28 ft. 2 in.

1906.
July.
27 ft. 10 in.
Aug.
28 ft. 2½ in.
Sept.
31 ft. 1 in.

1906.
Oct.
31 ft. 11 in.
Nov.
26 ft. 7 in.

1908.
Note. — After June observations were discontinued by State Rivers and Water Supply Commission.

1909.
22nd Aug.
32 ft. 2 in.

SOUTH AUSTRALIA.

AUGUST FLOOD NOTES.

Taken from Observers and Press Correspondents' Reports.

Upper North.

The only portion of this district reporting flood waters was about Melrose, where 4.47 inches of rain fell, or nearly 2 inches above the normal. All rivers were heavily flooded between there and Laura.

Lower North.

Pt. Broughton.—Floods out all over the Broughton (3rd August), from heavy rains in the hills around Clare. Flood waters within a few feet of the top of new bridge at Bruce's Crossing. Snow visible for first time this season on summit of the Flinders Range.

Crystal Brook.—Rivers flooded several times during the month.

Caltowie.—Terrific thunderstorm at 1.45 p.m. (19th); ½ inch in twenty minutes. All low ground inundated.

Yatina.—Flood on the 2nd.

Booyoolie.—Creek in flood all through the month.

Mt. Bryan.—Creeks have been continually running bankers. Mt. Bryan flats all under water.

Auburn.—Washaways severe; creeks running bankers. Crops showing signs too much rain. River Wakefield very high; and owing to floods several bridges washed away and traffic stopped.

West of the Murray Range.

Saddleworth.—Water across the main street.

Kapunda.—Overflowing and flooded creeks have caused considerable inconvenience and loss in many ways.

Angaston.—All small creeks about district frequently in flood, but not doing much damage.

Tanunda.—On 19th August River Para overflowed for first time since 1888.

Stockwell.—19th August. Every creek a banker. N. Para overflowed; hundreds of acres of wheat fields are under water, and the roads are quagmires.

Inglewood.—Heavy rains to-day (19th August), and Para River filled to overflowing; all low-lying ground flooded.

Nuriootpa.—20th August. Considerable damage was done by the heavy rains of last two days. At Light's Pass River Para was over a mile wide where it overflowed.

Yorke's Peninsula.

Maitland.—Exceptionally wet month; 20 to 100 acres under water in places. Afraid too wet for the crops.

Minlaton.—19th August. Heavy rains have filled all lagoons, and old residents say they have not seen so much water about for over twenty years.

District West of Spencer's Gulf.

White's Flat.—River in flood on 19th and 20th.

Bramfield.—Country in a boggy state; low lands flooded.

Pt. Lowly.—Tremendous rains have fallen, and the whole country is under water.

Cowell.—Remarkable rains have fallen this month.

Cummins.—19th August. Heavy rains, nearly 2 inches in ten hours, fell last night. Reservoir filled to utmost capacity—several million gallons—in about five hours, and burst its banks; the flood waters doing considerable damage to the railway.

Tumby Bay.—All creeks in the district are running bankers, and in some cases overflowing; suburban township blocks are submerged.

Mount Lofty Hills.

On these southern hills the storm rains of 19th were especially heavy, and all creeks and rivers, already swollen by flood rains the previous week, were in high flood. Washaways and serious landslips occurred in places, and considerable damage was done to crops and gardens. At Mt. Barker it is described as the biggest flood for many years. At Strathalbyn a terrific storm (1.26 inches rain) caused Angas River to overflow; and it is many years since the water rose to such a height. At Tanunda it is considered the heaviest flood since 1889.

The Adelaide and Gawler Plains.

Practically the whole of these plains from the city of Adelaide to beyond Mallala were inundated by flood waters from the hills. At Virginia the overflow of the Gawler River was the highest known and of the longest duration, the river being a mile wide in places, and for some 30 hours no decrease in the large volume of water flowing on both sides of the stream. At Salisbury, a large orange-growing district, the flood is described as the biggest known, and the loss to orange-growers was very great, hundreds of tons of fruit being swept away.

Around the city of Adelaide one of the greatest floods on record occurred, and some serious damage was done. At Fulham, on the west side of city, three big floods are reported during the month, with a record one on the 28th.

Mr. Thos. Gill, the Under-Treasurer for South Australia, forwards the following interesting notes on an effect of the heavy rainfall at Glen Osmond, at the foot of the hills near Adelaide:—"Owing to the exceptionally wet season, small springs are appearing on the surface of the sloping grounds in this locality, which is situated about 4 miles south-east of Adelaide, immediately under a portion of the Mt. Lofty Ranges. In one place the surface has risen about 3 feet, extending across portion of the road to Kensington. Road stopped pending draining. Temperature of the water is about 66 Fahr. at the surface; water of a creamy colour. Nothing of the like has occurred since the occupation of the district in 1838."

On 1st October he adds the following further notes:—

Glen Osmond.

"The springs in the road in this locality, to which reference was made last month, are still forcing their way above the roadway. Traffic has been diverted, and a deep drain has been cut on the east side of the road. Up to the present there is no perceptible diminution in the pressure of the water. A bore has been sunk, with the following results:—1st. Nine feet hard clay; next 11 feet soft yellow mud, then 6 feet of clay and gravel. The above was then cased with iron pipe, when clear fresh water rose in the pipe to about 12 feet above the surface of the road. The water thus tapped is below the coloured clayey water still oozing from the roadway in close proximity to the bore."

The Murray Valley.

Flood waters from the hills also spread out more or less over the whole of the flats bordering the Murray.

Eudunda.—Reports coming in show that all the low-lying country is under water. The lagoon between here and Robertstown has more water than for many years. Wheat washed away in some paddocks.

Truro.—All creeks and dams overflowing; roads impassable. Heavy rains in the Murray flats extending to Blanchetown.

Langhorne's-bridge.—On 19th and 20th very large flood; creek a banker for 24 hours. Another very high flood on 28th. Several floods came down Bremer this month besides these two, but not so high.

Woodchester.—Bremer River is running a banker. Hartley flats inundated. Fences swept away and crops much damaged.

Currency Creek.—All low-lying country flooded. Fencing swept away, and many crops under water.

Goolwa.—All low-lying land under water.

The South-east.

The rains in the early part of the month resulted in heavy accumulations of water all over the south-east. The Boolran and German Creek country was inundated. Large portions of the Kongorong country were under water, and at the Springs, 11 miles from Mt. Gambier, on the Millicent-road, the water at times reached the bottom of vehicles. A press correspondent, journeying by rail from Bordertown to Kingston, and thence by road to Robe and Beachport and on to Millicent, reports a sea of water in one apparently unbroken stretch.

The *Parrakie* rain observer reports:—Exceedingly wet in all the Hundreds in the Pinnaroo district; low-lying flats under water.

Crower.—Country in a very flooded state; as bad as 1906.

Penola.—Country under water. Some of the houses surrounded by water, and occupants forced to seek other shelter.

Pinnaroo.—On the 19th. Town is under water.

Bordertown.—19th. Tatiara Creek overflowed to an alarming extent; several families completely isolated. Post-office flooded, and had to be abandoned.

On the coast at Kingston and Cape Northumberland the weather was exceptionally wild and stormy on the night of the 19th as the cyclonic centre passed.

The following table gives the daily readings of the river gauges on the South Australian section of the Murray during September, October, and the early part of November, from which it will be seen that the crest of the flood wave reached Renmark about the middle of October, Overland Corner about the 23rd, and Morgan on the 26th :—

Date.	Renmark.						Overland Corner.						Morgan.					
	Sept.		Oct.		Nov.		Sept.		Oct.		Nov.		Sept.		Oct.		Nov.	
	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.
1 ..	..		16	8	18	0	..		16	3	..		..		17	1	22	6
2 ..	14	3	16	9	17	11	..		16	5	20	6	14	8	17	3	22	3
3 ..	14	3	..		17	10	..		..		20	5	14	9	..		22	3
4 ..	14	3	17	3	17	9	13	6	16	8	20	4	14	11	17	4	22	3
5 ..	..		17	6	17	7	..		..		20	3	..		..		22	1
6 ..	14	4	17	8	17	6	13	10	17	0	20	2	15	0	17	11	22	0
7 ..	14	5	17	11	..		14	0	17	3	..		15	2	18	3	..	
8 ..	14	6	18	2	17	4	14	2	17	5	20	2	15	2	18	6	21	9
9 ..	14	6	18	5	17	2	14	4	17	7	20	0	15	3	18	11	21	7
10 ..	14	6	..		17	0	14	5	..		19	10	15	4	..		21	6
11 ..	14	7	18	10	16	11	14	7	18	3	19	8	15	6	19	6	21	4
12 ..	..		18	11	16	10	..		18	5	19	6	..		19	10	21	3
13 ..	14	8	19	0	16	9	14	9	18	7	19	5	15	8	20	4	21	2
14 ..	14	9	19	2	..		14	10	18	10	..		15	9	20	5	..	
15 ..	14	9	19	2	..		..		..		..		15	9	20	9	..	
16 ..	14	10	19	2	16	4	14	11	19	4	19	0	16	0	21	3	20	9
17 ..	14	11	..		..		..		..		..		16	0	..		..	
18 ..	15	0	..		..		15	0	19	11	..		16	0	..		..	
19 ..	..		19	0	..		..		..		..		..		22	6	..	
20 ..	..		19	0	..		15	2	20	5	..		16	2	22	7	..	
21 ..	15	2	18	11½	..		..		20	8	..		16	3	22	9	..	
22 ..	15	3	18	11½	..		15	5	21	0	..		16	4	22	10	..	
23 ..	15	5½	18	10	..		15	7	21	0	..		16	5	22	10	..	
24 ..	15	6	..		..		15	9	..		..		16	6	..		..	
25 ..	15	7	18	6	..		15	9	20	11	..		16	7	22	11½	..	
26 ..	..		18	6	..		..		20	11	..		..		23	0	..	
27 ..	15	11	18	5	..		15	10	20	10	..		16	9	22	11	..	
28 ..	16	1	18	4	..		15	11	20	10	..		16	9	22	10	..	
29 ..	16	2	18	3	..		16	0	..		..		17	0	22	9	..	
30 ..	16	6	18	2	..		16	2	20	9	..		17	1	22	8	..	
31 ..	..		..		..		..		..		..		..		..		..	

At Mannum a press report, dated 26th October, states—"The river is still steadily rising, and is now within about 1 foot of the 1906 flood." The rain observer at Punyelroo, at the end of October, reports—"River is very high, about 15 feet above summer level; it is just 4 inches below 1906 level, and is now falling;" and the observer at Murtho states that, on the 16th (October), the river started to fall after getting within ¾ of an inch of 1906 flood level.

OBSERVERS' NOTES—AUGUST.

NEW SOUTH WALES.

Merriwee, Manilla,	30th—Bright morning; wild storm. 31st—Wild storm.
Mombil Government Tank	19th—Very high wind; very rough evening. 26th—12 p.m.—Rough wind from N.E.
Moorland ..	26th—Squally conditions.
Natin, Booligal ..	19th—Gale.
Nerrigundah ..	20th—Squally during the night.
Nethercote ..	23rd—Night squally and strong cold wind.
Normanstone Well, Gunnedah	17th—S.E. gale during night 21st—Strong gale. 26th, 27th, 28th—E. gales.
Nuntherungie ..	20th—Very heavy gales and dust storm, with thunder.

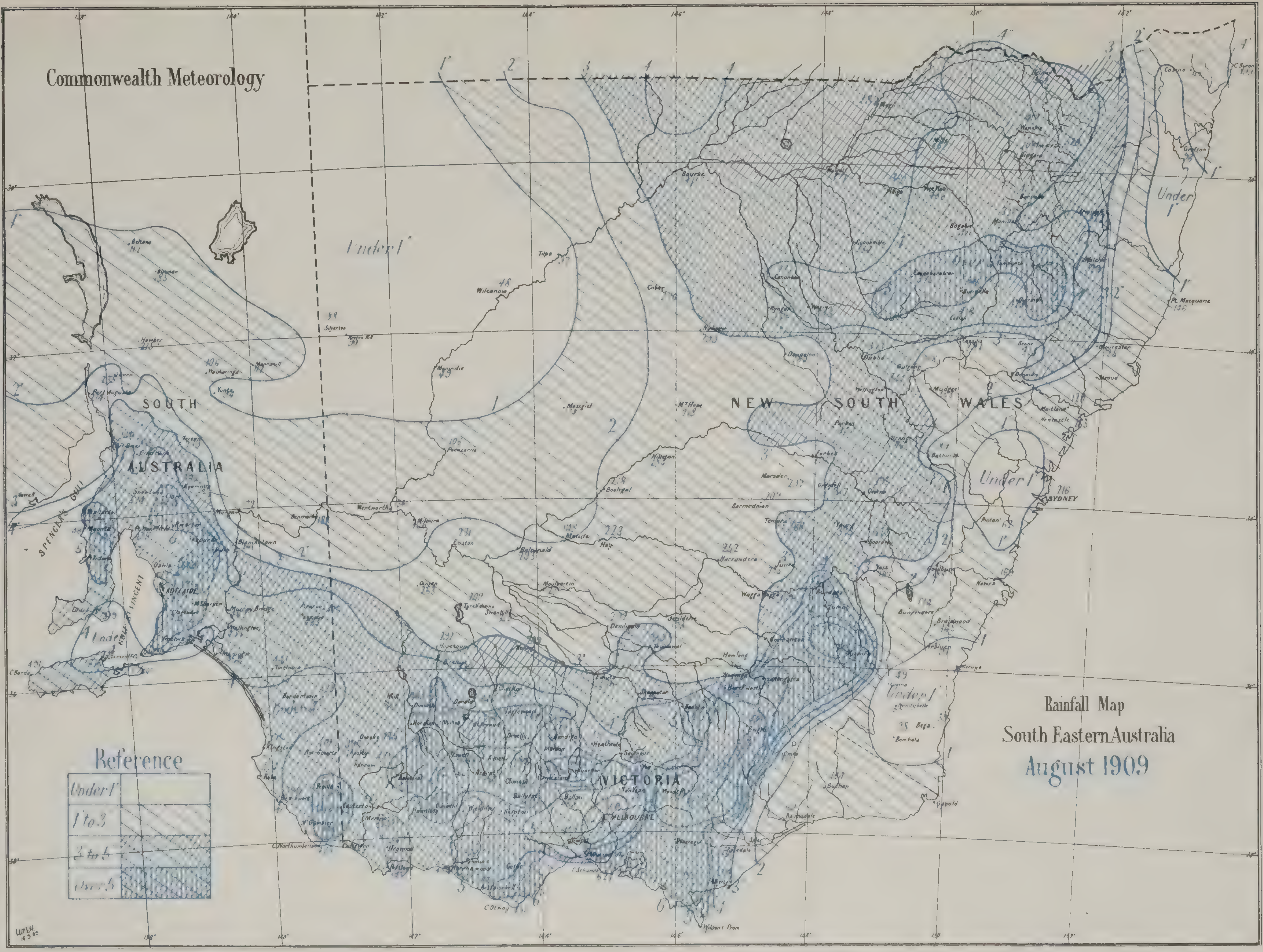
OBSERVERS' NOTES—NEW SOUTH WALES—*continued.*

Oatlands, Dundas	26th—Very squally showers came in gushes from S.E. 27th, 28th—Squally; showery.
Pleasant Valley ..	19th—Gale from N.E.
Seal Rocks ..	20th—Moderate gale. 25th—Moderate S.W. gale.
Somerton ..	20th—Gale from the N. 30th—Strong W. gale, with thunderstorms.
Talmalmo ..	19th—Great gale at night, with thunder and rain. 20th—Squally, boisterous day.
Warmatta ..	19th—Hurricane in the afternoon.
Wolumla ..	20th—Squall, with sprinkle, 4 a.m.
Woolgoolga ..	20th—Squally night and morning.
Yantara Station ..	19th—Big dust storm all day; showers in evening.

FLOOD NOTES.

Abercrombie Caves	359 points—Creek in flood.
Barnato ..	392 points—Floods.
Brungle ..	486 points—River and creeks in flood during the month.
Cobwell	259 points—Rivers all in high flood, equal to 1906.
Collie West ..	395 points—Creeks flooded.
Colma	319 points—Castlereagh River in flood.
Conargo ..	198 points—River a banker.
Corrong Station ..	242 points—River in a state of flood.
Cunninyurk ..	260 points—The rivers and creeks are all in flood, and a great deal of country is under water, and from the state of rivers and creeks, may be for some time yet.
Darlington Point ..	149 points—River has been a banker all the month, having risen to 20 feet.
Devon Court, Guyra	527 points—Ground full of water; creeks and gully continually in flood.
Emmaville ..	566 points—Rivers in the district have been in a flooded state.
Jingellic ..	557 points—Very mild season, with big floods.
Kingstown ..	452 points—River in a state of flood during all the latter part of the month.
Lankey's Creek ..	701 points—Floods; country boggy with water.
Meilwan ..	277 points—An enormous body of water passing down the river, which has already overflowed its banks in a lot of places; river still rising, and a record flood probable.
Moama ..	273 points—Floods.
Moolpa	234 points—River is a banker, and will be higher yet.
Somerton ..	391 points—The river has been in flood three times during the month, and is still rather high.
Talmalmo ..	585 points—Two moderately high floods during the month.
Taminit, Euston ..	248 points—On the frontage the river is flooding most of the good country.
Tangley	519 points—20th—Creeks flooded in places.
Wanaaring Station	154 points—River in flood from Queensland rains.
Woolbrook ..	441 points—River in flood for the past three weeks.
Yarrangobilly Caves	20th—Heavy flood.
Zara	286 points—Creeks high from floods in Murrumbidgee.

Commonwealth Meteorology



Rainfall Map
South Eastern Australia
August 1909

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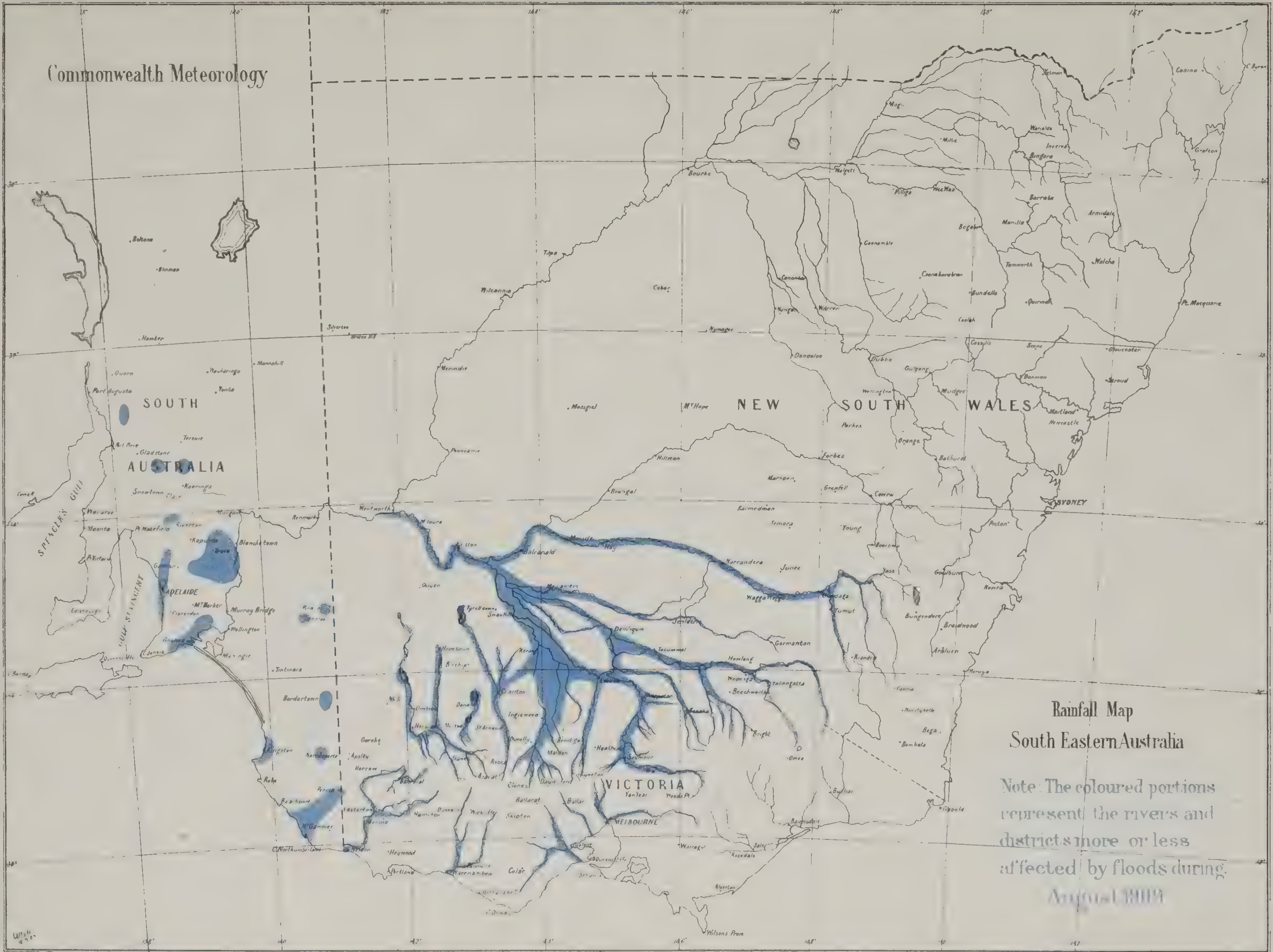

Commonwealth Meteorology

Rainfall Map
South Eastern Australia

Note: The coloured portions represent the rivers and districts more or less affected by floods during August 1909

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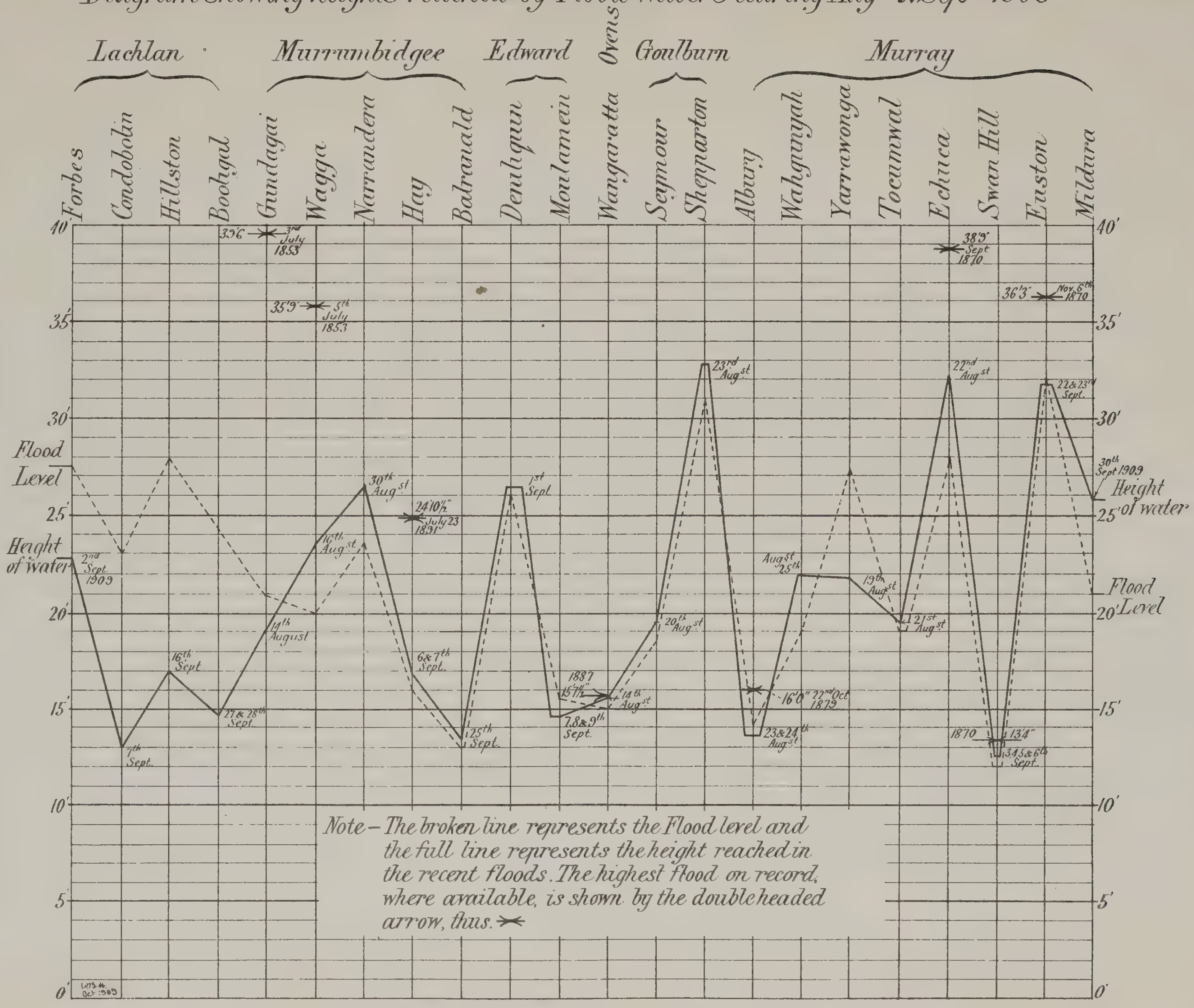
Diagram showing heights reached by Flood waters during Aug^st. & Sep^tr. 1909



Note—The broken line represents the Flood level and the full line represents the height reached in the recent floods. The highest flood on record, where available, is shown by the double headed arrow, thus. ⟷

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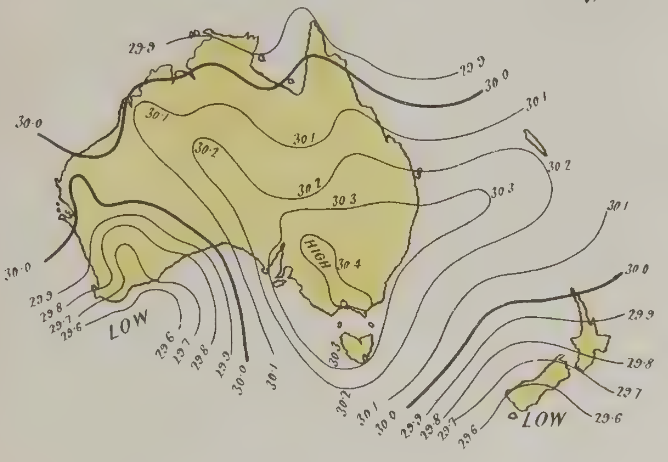
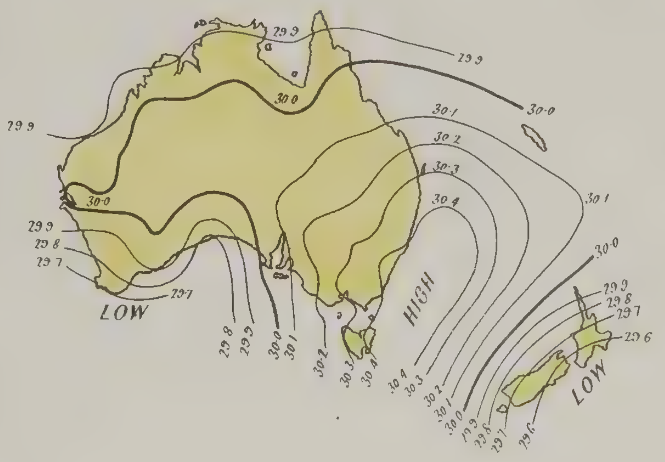
Weather Charts

Monday
16th Aug. 1909

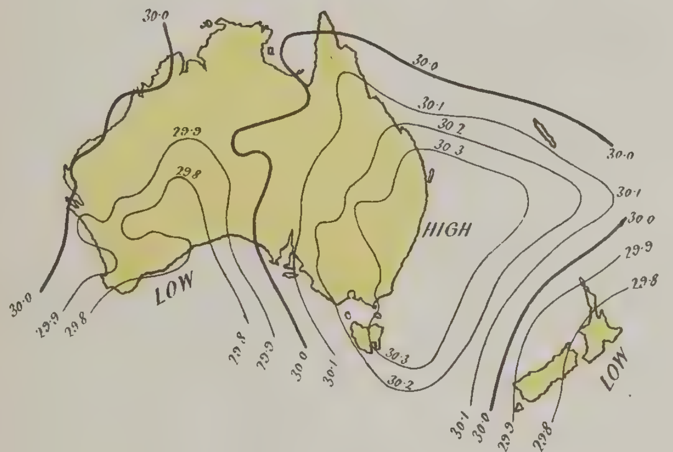


Weather Charts

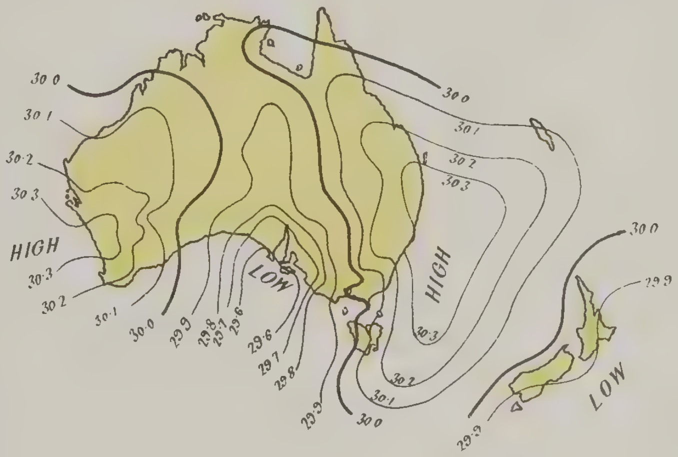
Tuesday
17th Aug. 1909



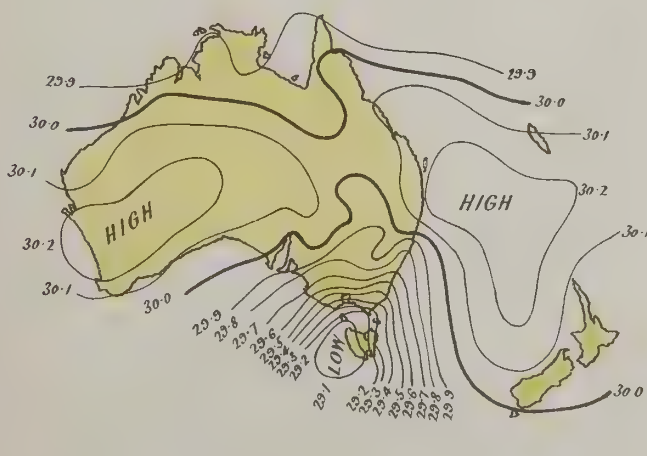
Wednesday
18th Aug. 1909



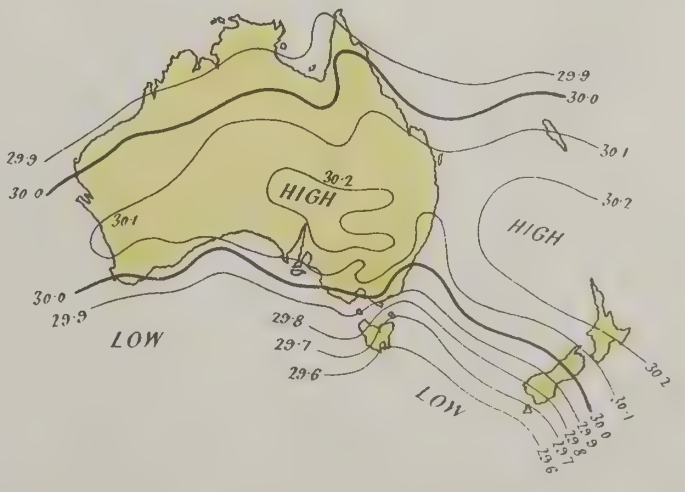
Thursday
19th Aug. 1909



Friday
20th Aug. 1909



Saturday
21st Aug. 1909



14734
Sep. 09.

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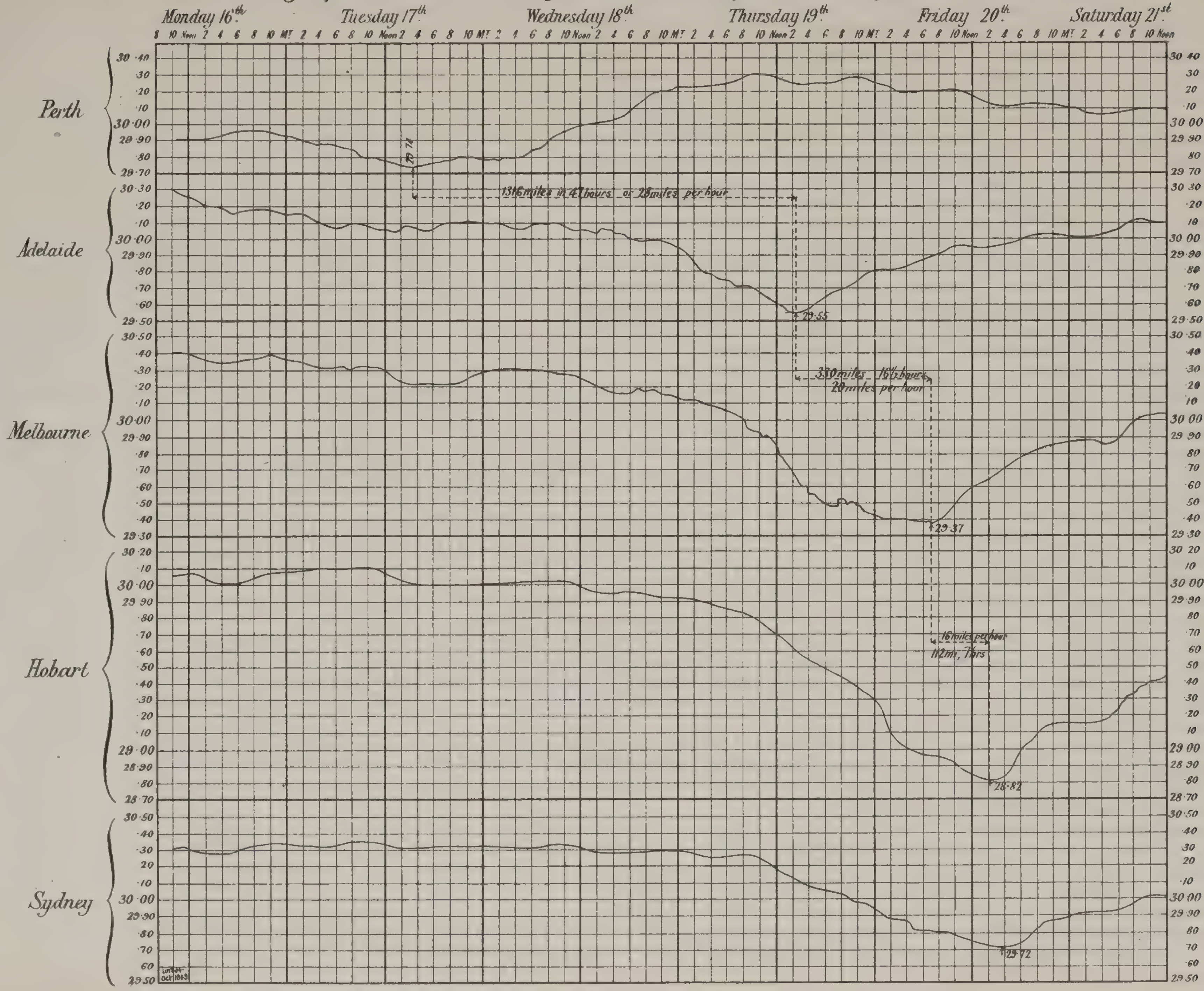
Barograph curves showing extreme range from August 16th to 21st 1909



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APPENDIX.

Rainfall over the Darling Catchment:—

Mean Rainfall over the Darling Catchment. Inches Rain.		Mean height of river above summer level. ft.	in.	Amount of Rainfall above or below average.
In 1908—23.52	.. ..	5	7	.. + .84
1907—22.96	.. ..	4	0	.. + .28
1906—25.12	.. ..	6	11	.. + 2.44
1905—20.29	.. ..	6	10	.. – 2.39
1904—21.37	.. ..	7	3	.. – 1.31
1903—24.43	.. ..	11	3	.. + 1.75
1902—12.35	.. ..	0	6	.. –10.33
1901—17.35	.. ..	2	8	.. – 5.33
1900—18.91	.. ..	7	2	.. – 3.77
1899—17.59	.. ..	4	6	.. – 5.09
1898—18.90	.. ..	7	4	.. – 3.78
1897—19.75	.. ..	9	1	.. – 2.93
1896—23.23 ;	of this only $\frac{1}{125}$ or 0.78 per cent. passed Bourke	4	7	.. + .55
1895—21.15 ;	,, $\frac{1}{192}$ or 0.52 ,, ,,	3	0	.. – 1.53
1894—25.50 ;	,, $\frac{1}{47}$ or 2.09 ,, ,,	14	3	.. + 2.82
1893—26.00	,, $\frac{1}{35}$ or 2.85 ,, ,,	19	7	.. + 3.32
1892—25.55 ;	,, $\frac{1}{62}$ or 1.60 ,, ,,	10	11	.. + 2.87
1891—29.60 ;	,, $\frac{1}{43}$ or 2.31 ,, ,,	18	3	.. + 6.92
1890—36.36 ;*	.. ..	23	10	.. +13.68
1889—30.31 ;	of this only $\frac{1}{95}$ or 1.06 per cent. passed Bourke	8	7	.. + 7.63
1888—12.05 ;	,, $\frac{1}{99}$ or 1.00 ,, ,,	3	2	.. –10.63
1887—32.99 ;	,, $\frac{1}{59}$ or 1.69 ,, ,,	14	11	.. +10.31
1886—29.00 ;	,, $\frac{1}{46}$ or 2.20 ,, ,,	16	3	.. + 6.32
1885—18.86 ;	,, $\frac{1}{57}$ or 1.61 ,, ,,	0	8	.. – 3.82
1884—14.75 ;	,, $\frac{1}{1054}$ or 0.09 ,, ,,	0	9	.. – 7.93
1883—15.30 ;	,, $\frac{1}{120}$ or 0.83 ,, ,,	3	4	.. – 7.38
1882—23.92 ;	,, $\frac{1}{180}$ or 0.55 ,, ,,	3	7	.. + 1.24
1881—18.88 ;	,, $\frac{1}{670}$ or 0.15 ,, ,,	0	9	.. – 3.80
1880—20.74 ;	,, $\frac{1}{80}$ or 1.25 ,, ,,	6	8	.. – 1.94
1879—33.71 ;	,, $\frac{1}{43}$ or 2.33 ,, ,,	29	1	.. +11.03
Mean 22.68	1.35 mean	8	6	

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* Flood overflowed banks so much that no estimate of the quantity that passed can be made.

In the absence of a river section at the weir, it is impossible to estimate the percentage of rainfall which passed Bourke since 1896.

As indicating the tropical character of the rainfall that affects the Darling, it may be interesting to state that the summer floods during the past years began at Bourke on the following dates :—

1879.—1st March—Rose slowly, lasted nine months.

1880.—10th February—Rose suddenly 22 feet, lasted four months.

1881.—25th January—Rose slowly 8 feet, lasted six weeks.

1882.—4th February—Rose very suddenly 26 feet, lasted two months.

1883.—24th February—Rose slowly 15 feet, lasted six weeks.

1884.—19th February—Rose suddenly 8 feet, lasted two weeks.

1885.—22nd January—Rose suddenly 28 feet at Wilcannia, lasted four weeks.

1886.—5th June—Rose rapidly to 28 feet by 28th June, lasted to end of year; highest on August 31st, 37 ft. 6 in.

1887.—30th January—Rose rapidly 31 ft. 3 in. by 10th March, lasted to 17th June.

1888.—10th February—Rose rapidly to 26 feet by 20th March, lasted to 16th April.

1889.—9th April—Rose rapidly 6 feet, but was down again by 20th May.

1890.—30th January—Rose steadily to 42 ft. 7¾ in. by 23rd April.

1891.—12th January—Rose steadily to 36 ft. 2 in. on 23rd February.

1892.—13th April—Rose irregularly to 14 ft. 6 in. on 16th July.

1893.—13th February—Rose steadily to 34 ft. 8 in. on 26th March; a second flood began 10th June, and rose steadily to 39 ft. 3½ in. on 15th July.

1894.—15th March—Rose steadily to 34 ft. 4 in. on 26th April, and then fell slowly, except slight freshes, to 31st December.

1895.—20th January—Rose rapidly to 25 feet, 27th February; fell rapidly to the end of April.

1896.—11th February—Rose rapidly to 21 ft. 8 in. on 15th February.

1897.—23rd August—Rose steadily from 1st June to 28 ft. 10 in.

1898.—25th February—Rose steadily from 10th January to 28 ft. 11 in.

1899.—3rd March—Rose rapidly from 22nd February to 20 ft. ½in.

1900.—6th August—Rose rapidly from 7th July to 22 ft. 9 in.

1901.—25th September—Rose rapidly from 26th August to 19 feet.

1902.—12th December—Rose rapidly from 9th December to 4 ft. 5 in.

1903.—6th November—Rose steadily from 2nd October to 30 ft. 11 in.

1904.—29th March—Rose steadily from 3rd March to 18 ft. 3 in.

1905.—11th and 12th May—Rose steadily from 15th April to 18 ft. 9 in.

1906.—27th October—Rose steadily from 17th September to 29 ft. 6 in.

1907.—16th January—Rose suddenly from 12th January to 19 ft. 9 in.

1908.—15th and 16th April—Rose steadily from 22nd February to 30 ft. 1 in.

List of the great floods in the Darling, at Bourke :—

		ft.	in.	
1852	July ..	38	0	(?) No proper gauge.
1863	October ..	40	0	(?) 38 feet at Cultowa.
1864	18th March ..	43	2	Another flood in September, 42 feet at Cultowa, in March.
1867	February ..	37	0	(?) No proper gauge.
1870	8th July ..	38	5½	Observed at Cultowa.
1871	4th January ..	37	3	,, ,,
1873	14th July ..	38	4	
1876	14th August	35	0	
1879	17th October..	39	8	
1886	31st August ..	37	6	
1890	23rd April ..	42	7¾	
1891	23rd February	36	2	
1893	15th July ..	39	3½	
1894	26th April ..	34	4	
1895	27th February	25	0	
1896	15th February	21	8	
1897	23rd August	28	10	
1898	25th February	28	11	
1899	3rd March ..	20	0½	
1900	6th August ..	22	9	
1903	6th November	30	11	
1906	27th October..	29	6	
1908	15th and 16th April	30	1	

A brass plate marking the exact height of the 1890 flood has been fixed on the post-office. The heaviest part of this flood came down the Macintyre.

Rainfall and discharge of the Murray River at Euston :—

Year.	Mean Rainfall over the Murray Basin.	Percentage passing down the river at Euston.	*Mean height of river above summer level. feet	in.	Amount of Rainfall above or below average.
1908	17.97	19	5	2	−2.74
1907	16.45	25	6	0	−4.26
1906	26.03	34	13	3	+5.32
1905	20.91	26	8	2	+0.20
1904	18.45	30	8	3	−2.26
1903	20.23	21	6	3	−0.23
1902	11.88	7	1	3	−8.83
1901	16.04	26	6	2	−4.67
1900	22.35	29	9	5	+1.64
1899	15.64	27	6	2	−5.07
1898	15.78	27	6	4	−4.93
1897	17.77	21	5	9	−2.94
1896	18.28	22	6	3	−2.43
1895	15.90	35	9	6	−4.81
1894	30.11	42	16	4	+9.40
1893	23.30	36	12	8	+2.59
1892	21.97	29	9	8	+1.26
1891	27.82	32	13	5	+7.11
1890	26.45	39	11	0	+5.74
1889	27.82	33	13	8	+7.11
1888	13.63	42	8	7	−7.08
1887	32.79	27	13	6	+12.08
1886	20.37	21	5	6	−0.34
1885	19.17	22	6	0	−1.54
1884	16.00	25	5	9	−4.71
1883	22.00	26	8	5	+1.29
1882	24.00	20	7	2	+3.29
	20.71 mean	27.5 mean			

It must, however, be understood that these estimates of the water passing down the western rivers are only based on the best available information. Before accuracy can be obtained, detailed surveys are absolutely necessary, also daily records of the velocity of the current. At present we have only old sections of the river and an approximate velocity of current; and I assume that the Murray catchment in Victoria receives the same rainfall as that in New South Wales, and that the Queensland portion of the Darling catchment receives the same quantity of rain as that in New South Wales.

The following lists of floods in the Murray at Albury, Euston, and Moama are interesting and useful :—

FLOODS.

Year.	*Albury.* Date.	ft.	in.	*Euston.** Date.	ft.	in.
1908	22nd October	10	4	6th October	*13	1
1907	27th September	8	0	1st January	*16	10
1906	6th October	14	7	9th-10th November	*26	6
1905	13th July	14	0	21st September	*21	1
1904	7th November	11	4	10th-14th October	*16	3
1903	26th October	9	9	26th-31st October	*14	10
1902	6th November	4	7	1st January	*6	0
1901	1st November	12	4	30th-31st October	*16	2
1900	5th September	11	10	16th-18th October	*21	3
1899	27th-28th January	10	7	5th August	*16	2
1898	1st November	10	9	12th-13th October	*15	0
1897	4th September	11	9	6th October	*17	9
1896	22nd September	9	0	17th October	*12	5
1895	9th September	13	3	1st January	*19	10
1894	13th September	14	3	19th October	*27	4
1893	6th October	12	10	19th November	*23	0
1892	14th November	13	9	6th November	*19	2
1891	22nd January	13	1	18th August	*26	3
1890	18th October	11	6	24th September	*22	8
1889	13th September	15	3	15th October	27	1
1888	27th September	11	7	3rd January	23	7
1887	8th November	14	6	13th September	29	9
1886	13th September	12	0	11th November	15	7
1885	18th September	13	8	30th October	15	4
1884	27th October	6	11	3rd January	12	0
1883	10th October	12	11	15th November	19	0
1882	2nd September	12	11	10th October	16	6
1881	11th May	10	9	26th September	12	10
1880	30th June	13	5	3rd November	21	6
1879	22nd October	16	0	2nd December	22	3
1870	..	..	..	6th November†	36	3

Moama.

Year.	Date.	ft.	in.
1863	23rd September	30	6
1864	4th November	27	6
1865	23rd September	18	4
1866	29th August	23	9
1867	16th October	34	5
1868	14th October	18	3
1869	3rd November	20	10
1870	6th November	38	0
1871	11th October	28	7
1872	26th October	29	4
1873	10th September	25	4
1874	10th October	28	8
1875	16th September	30	7
1876	10th October	18	4
1877	26th June	18	4
1878	18th November	24	11
1879	5th November	24	8
1880	30th September	27	3
1881	30th August	18	3
1882	18th September	22	0
1883	6th September	25	9
1884	27th August	12	0
1885	12th October	24	7
1886	18th September	20	8
1887	17th August	30	7
1888	7th August	21	0
1889	12th-23rd September	32	0
1890	30th August	28	2
1891	27th July	28	8
1892	19th September	25	4
1893	17th October	29	10
1894	21st September	31	7
1895	23rd September	25	8
1896	21st July	17	8
1897	17th September	24	3
1898	21st September	21	11
1899	8th-13th July	24	11
1900	13th and 15th September	26	4
1901	6th, 7th, 8th, and 12th October	22	10
1902	29th-30th June	8	9
1903	28th July	28	8
1904	19th-20th September	30	0
1905	9th and 11th August	34	2
1906	12th October	38	0
1907	9th September	24	7
1908	5th September	22	10

FLOODS ON THE MURRAY.

The following interesting historical notes have been supplied by Mr. J. W. Walker, a pioneer of the milling industry on the Murray, who has lived at Mannum (South Australia) for over 30 years, has made a close study of the river in all its moods, and has kept a record of its levels at the most important towns :—

The first record refers to the flood on the Murrumbidgee, known as "The Gundagai Flood," more than 50 years ago. Much damage was done to the stockyards and houses of settlers. The water rose so high that the old house of Mr. E. J. Eyre (Protector of Aborigines), at Moorundie, was washed away, and the doors and windows of the police station at the same place forced in. Previous to 1852, the Rufus tribe of blacks used to attack overlanders at the Rufus and higher up, and Mr. Eyre was sent out as protector and mediator. In June, 1852, the lower part of Gundagai Flat was washed away, 71 houses being destroyed, and 81 lives lost. The graves of many of the drowned are still to be seen in Yass cemetery.

The 1870 *Flood.*

The flood of 1870 was the highest known since records have been kept. The maximum levels for that year were :—Echuca, 38 ft. 9 in.; Wentworth, 30 feet; Bourke, said to have been nearly 40 feet; Morgan, 32 feet; Mannum, 14 ft. 6 in.; Murray Bridge, a little less. Echuca was twice flooded—in July and

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* In 1890 the zero of the river gauge at Euston was lowered 4 feet 8 inches; but here the old zero has been used for convenient comparison with previous floods.

* The old zero of the river-gauge is used here to make the floods comparable throughout. From 1890 to 1896 inclusive the new gauge was used in the Rain Reports; but now the old zero is used throughout the record.

† The exact date at Euston is not known, but 6th November is the date of the highest point of that flood at Moama. The height there was 38 feet.

November. The Murrumbidgee was in high flood also, and Mr. Walker states that an old river skipper, who was then in business at Wagga Wagga, said he and a number of residents sought refuge from the floodwaters on the first floor of an hotel which was considered to be above the reach of the flood on account of it being higher than other buildings. But the waters rapidly rose, and the people were compelled to climb into a attic, break the shingles, and seek refuge on the roof, where they were rescued by the police boats at daylight. The Darling was many miles in width, and the steamer *Ariel* went a distance of 60 miles from the main stream for a load of wool. In Mannum Reach, on 6th August, 1870, the water was 9 feet above summer level.

The next big flood occurred in 1889. The river commenced rising at Echuca, where, on 30th June, it was 31 feet. This was caused by heavy floods in the Goulburn and Darling Rivers, it being 32 feet at Walgett, on the Darling. Early in September, more floods occurred in the Upper Murray and in the Murrumbidgee, Edwards, and Goulburn Rivers, caused through the thawing of the snow. The highest reading at Echuca was registered on 30th September, when it rose to 32 ft. 9 in. The river was said to be 2 inches higher at Tocumwal than it was during the 1870 flood. The following were some of the readings for the latter part of the year :—16th to 21st August, Wentworth, 23 feet; 24th and 25th October, Wentworth, 25 feet; 1st November, Morgan, 24 feet; 15th to 29th November, Mannum, 6 ft. 8 in.; Walgett, 32 feet; Gundagai, 26 feet.

The 1890 *Flood.*

Another big flood occurred in 1890. The highest floods ever known in Queensland were experienced from March to 10th April. St. George, on the Barwon, was flooded. Great floods occurred also on the Darling. Walgett was inundated, and 200 people washed out, and Brewarrina was also flooded. On 18th April, the river rose to the unprecedentedly high level of 42 feet above summer level. The town was dammed by an embankment, which, however, gave way, and the town was flooded. In striking contrast to this was a picture taken during the 1902 drought. The wharves at Bourke were shown 30 feet out of the stream. There was merely a trickle of water, and several flourishing vegetable gardens were seen in the bed of the river. What an argument in favour of locking the river! The Murray started rising on 19th June, 1890, and the following are some of the levels recorded :—20th June, Wentworth, 21 ft. 11 in.; 30th August, Echuca, 38 feet; 29th September, Wentworth, 23 ft. 3 in.; 8th to 13th September, Morgan, 25 ft. 1 in.; 15th October, Mannum, 8 ft. 9 in. The river was said to be 48 feet at Walgett. During the flood, steamers frequently left the river, went in over the flat, and berthed alongside the main street at Mannum, the *Tyro* doing this regularly for two months, and discharging her passengers and cargo in the street. The majority of landing places along the river were under water, and the *Tyro* frequently left the stream, steamed a considerable distance in the gullies, and took in wheat.

In 1891, there was a heavy flood in the Murrumbidgee. Wagga was partly submerged, and the river was 34 feet high. Goulburn was also flooded. The following were some of the levels :—2nd July, Wagga, 34 feet; 15th and 16th July, Albury, 13 feet; 3rd August, Echuca, 27 ft. 4 in.; 27th August, Walgett, 34 ft. 10 in.; 27th August, Wilcannia, 31 ft. 11 in.; 1st, 2nd, and 3rd September, Wentworth, 23 ft. 8 in.; 21st to 24th September, Morgan, 22 ft. 9 in.; 24th September, Mannum, 5 ft. 8 in. In 1893, a big flood occurred in the Darling. The Murray and the Murrumbidgee began to rise early in June. On 14th July, the Darling, at Bourke, registered 39 ft. 3 in. The country was inundated, and the lessees washed out. The general opinion was that the river would reach the 1890 level. At Mooroopna, the river rose to 30 feet. For six days the river registered 29 ft. 6 in. at Echuca. The following are some of the levels :—14th July, Bourke, 39 ft. 3 in.; 18th July, Louth, 41 ft. 4 in.; 14th to 16th July, Wilcannia, 34 ft. 9 in.; 28th September, Goulburn, 30 feet; 6th October, Albury, 12 ft. 10 in.; 10th to 19th October, Echuca, 29 ft. 6 in.; November, Wentworth, 21 ft. 7 in.; 13th October, Morgan, 22 ft. 2 in.; 13th October, Mannum, 4 ft. 6 in.

Early in April, 1894, there was a big rise in the Darling, and on the 5th of that month the Barwon registered 39 ft. 9 in. At Wilcannia, the water overflowed the banks. Following are some of the levels :—5th April, Barwon, 39 ft. 9 in.; 6th April, Namoi, 30 ft. 9 in.; 24th April, Bourke, 34 ft. 3 in.; 12th June, Wilcannia, 33 ft. 7½ in.; 21st April, Gundagai, 28 feet; 25th July, Goulburn, 30 feet; 4th to 23rd August, Echuca, 30 feet; 31st August. Echuca, 31 feet; 11th September, Echuca, 31 ft. 6 in.; 15th to 17th September, Wentworth, 24 ft. 11 in.; 13th to 15th November, Morgan, 24 ft. 5 in.; Mannum, 7 ft. 4 in.

In 1899, there were serious floods in Victoria, particularly on the Campaspe. In 1900, the river was so low that steamers could not get to Blanchetown for weeks, and horses and vehicles could be driven across the river in several places. On 6th July, tremendous floods occurred on the Murrumbidgee—the worst since 1870. Yass was washed out, and fears entertained for Gundagai. The floods were caused by heavy falls of snow, the heaviest on record. There was also heavy rain. When snow and rain water comes together, damage always occurs. Forbes, on the Lachlan, was under water, and immense damage was done. At Mannum, the river rose to 3 ft. 3 in.

The other extreme was experienced in 1902. The Darling was a mere trickle, the Bourke wharves being 30 feet out of the water. Saltwater fish were caught at the Burdett Quarries and Caloote, nearly 90 miles inland. The *Florence Annie* was high and dry in the bed of the Darling for sixteen months. She was splendidly built, however, and did not go to pieces; but, after a bit of caulking, was brought to the dock at Mannum for repairs. Her skipper said he had had only seven months' running in three years. In 1903, the water came down again, and the River McIntyre rose high at Goondiwindi.

In 1905, there were heavy rains at the head of the Murray, 5 inches falling at Kiandra, and miles of country was submerged. Tumut and the adjacent rivers were in heavy flood, and the country around Albury was submerged, also Beechworth and Goulburn. In July, at Albury, the river registered 14 feet, and much damage was done through the levees giving way.

The 1906 *Flood.*

On 10th September, 1906, there were extraordinarily heavy rains in Victoria. Five inches fell on the Campaspe, which put the river in high flood. The town of Rochester was submerged, the water being in the main street. Seymour, on the Goulburn, was flooded on the same date. Water from the Campaspe inundated the country from Parke's Plains to the Murray, and was reported to be 2 feet higher than in 1870. On 2nd October, further floods occurred in nearly all the Victorian rivers, and at Wodonga all the country in the vicinity of the river was submerged. On 5th October, the Mitta Mitta was rising fast, and tremendous floods were anticipated. The Broken River, at Molesworth, was in heavy flood, and the country was under water for miles. At Echuca, the water was up to the Town Hall steps, and families had to flee from their homes. The Murrumbidgee was in high flood. Gundagai registering 25 ft. 6 in. whilst at Albury the water rose to 13 ft. 10 in. This was caused by a monsoonal disturbance. The following are some of the levels for that year :—3rd July, Albury, 13 ft. 6 in.; 20th and 21st July, Echcua, 28 feet; 12th and 13th October, Echuca, 31 ft. 10 in.; 2nd November, Barwon, 25 ft. 8 in.; 2nd November, Brewarrina, 19 ft. 9 in.; Bourke, 20 feet; 12th November, Euston, 31 ft. 6 in.; 20th November, Wentworth, 23 ft. 7½ in.; 1st December, Renmark, 19 ft. 1 in.; 5th and 6th December, Morgan, 22 ft. 7 in.; December, Mannum, 6 feet.

This Year's Flood.

This year's flood on the Murray was caused by the heavy rains in Victoria on 26th, 27th, and 28th June, and 9th, 10th, and 21st August, and the Darling flood later on. The river tapped the 1906 level at Morgan (22 ft. 6 in.), reaching 23 feet at the end of October, and staying at that level for several days. At Mannum and Murray Bridge, however, the river will not reach the 1906 level.

(NOTE.—1909, at Mannum and Murray Bridge. Maximum level was 6 inches *less* than that of 1906.)

MURRUMBIDGEE FLOOD LEVELS.

The following valuable table of Murrumbidgee floods (prior to 1903) was copied from the *Wagga Wagga Express* Directory; except the floods of 1844 and 1852, together with the dates on which the floods of 1853, 1867, and 1869 occurred, which have been extracted from Mr. James Gormly, M.P.'s, letter, and other notes on the subject :—

	Gundagai.			*Wagga.*		
		ft.	in.		ft.	in.
1844	October	29	0	October	36	0
1852	26th June	38	0	June	35	0
1853	3rd July	39	6	5th July	35	9
1867		28	9		30	7
1869		26	4		29	10
1870	26th April	38	0	April	35	0
1870	14th May	32	0	May	32	6
1870	4th June	28	6	June	30	3
1878	5th November	27	6	November	29	6
1879	18th September	33	6	20th September	30	8
1891	18th January, 6 p.m.	28	0	20th January, 8.30 a.m.	28	0
1891	18th January, 10 p.m.	31	0	20th January, 2 p.m.	29	3
1891	18th Jan., midnight	31	6	20th January, 11 p.m.	30	4
1891	27th June, 2.30 p.m.	25	0	28th June, 8.30 a.m.	28	0
1891	27th June, 8 p.m.	29	9	28th June, 6 p.m.	28	6
1891	27th June, 10 p.m.	30	9	28th June, 8.30 p.m.	30	3
1891	28th June, 9 a.m.	35	6	29th June, 3 a.m.	34	4
1891	12th July, 5 p.m.	27	6	13th July, 8.30 a.m.	28	6
1891	12th July, 9 p.m.	30	0	13th July, 5.15 p.m.	31	1
1891	12th July, 11 p.m.	32	0	13th July, 11 p.m.	31	9
1892	26th September, noon	24	6	28th September, midnight	24	11
1892	18th October, noon	26	0	20th October, noon	27	4½
1894	21st April	28	0	23rd April	29	9
1895	19th September	11	0	20th September	16	0
1896	25th June	12	0	27th June	13	0
1897	13th January	13	6	14th January	16	0
1898	17th February	13	0	18th February	17	0
1899	14th August	23	0	16th August	23	9
1900	7th July	27	6	7th July	32	4
1901	30th October	20	3	1st November	22	4
1902	20th December	6	0	22nd December	6	6
1903	19th September	15	6	21st September	19	6
1904	5th January	12	6	6th January	13	8
1905	11th July	25	0	14th July	27	0
1906	5th October	25	6	6th October	28	6
1907	19th December	11	0	20th December	10	4
1908	9th September	12	0	10th September	15	9

EARLY FLOODS IN THE UPPER MURRUMBIDGEE.

Mr. James Gormly, M.P., has been kind enough to give me for publication his recollections of the early floods in the Murrumbidgee. His letter is dated 23rd May, 1898, and reads as follows :—

“ The floods of 1852 and 1870 in the Murrumbidgee were about the same height at Gundagai, and exactly the same height at Wagga Wagga. I was in the flood at Gundagai in 1852, when the town was swept away, and in Wagga Wagga a few days after the same flood. I was in Wagga Wagga when the flood of 1870 took place.

“ The highest flood in the Murrumbidgee that is known to white men occurred at Gundagai on 3rd July, 1853. This flood was at Gundagai 1 ft. 6 in. higher than that of the previous year, and 9 inches higher at Wagga Wagga than the floods of 1852 or 1870.

“ A flood occurred in the river at Wagga Wagga, which rose about 31 feet, or 4 feet lower than the floods of 1852 and 1870.

“ I was at Gundagai when the 1853 flood took place, and rode to Wagga Wagga, and crossed the river in a boat, when the flood had only fallen a few feet; so I can be accurate about the floods of 1852, 1853, and 1870.

*“ I arrived on the Murrumbidgee the year after the flood of 1844, which took place in the month of October, and have seen the flood-marks of the 1844 flood, both at Wagga Wagga and Gundagai; you can rely on my statements as being correct.”

FLOODS.

“ Australian Dictionary of Dates,” under the heading “ Gundagai ” :—The first flood in Gundagai occurred in February, 1844. The great flood that swept away the town occurred 26th June, 1852. Eighty-nine persons were drowned out of 250.

New South Wales Gazetteer, Gundagai :—“ Land was first sold 1840. November, 1844, the inhabitants were for the first time dismayed by the flooding of the Murrumbidgee, which submerged the little village to the depth of 4 feet.” “ On 25th June, 1852, the river came down in such a body as to overwhelm the surrounding country for miles, and the entire valley of the Murrumbidgee became an inland sea.” “ The town of Gundagai was swept away, and 89 persons, out of a population of 250, perished.” “ On the 16th of September, 1858, Captain Francis Cadell ascended the Murrumbidgee, and arrived at Gundagai in his large steamboat *Albury*.”

Jevon's “ Some Data concerning the Climate of Australia and New Zealand ” :—“ About 11 o'clock at night, on Friday, 25th June, 1852, the inhabitants at Gundagai were awakened from their sleep by the deafening roar of the Murrumbidgee.” “ The work of destruction was but that of a few minutes, and then the current bore away the lifeless bodies of 89 of the inhabitants.” An eye-witness states that the river rose rapidly on 24th June, being bank-high by the evening. Such a fresh created no alarm, as it was quite usual in the winter months. On the 25th, however, it continued rising, and at 10 p.m. was higher by 8 or 10 feet than at the previous flood (1844). Forty feet is by some stated as the total height.” * 1853—Just a year after the disastrous flood at Gundagai, on 3rd July, there was a considerable flood, and then heavy rains fell on 9th, 10th, and 11th; and about 3 p.m. on the 13th the flood broke over the banks, laying the town of South Wagga Wagga under water. All the inhabitants made a timely retreat, with such few things as they could carry, to a neighbouring sandhill. At 12 p.m. of the 13th the water stood as high as during the flood of 1852. By 2 a.m. of 14th it had risen 14 inches, but in an hour more it was falling. Gundagai was again ruined.

FLOODS IN THE MACQUARIE RIVER AT DUBBO.

Year.	Height.		Date.
	ft.	in.	
1867	46	0	
1886	36	0	10th December, 5.a.m.—First official record
1887	38	3	2nd September.
1890	42	0	March.
1892	45	6	September.
1893	28	6	1st June.
1893	24	0	19th July, at 4 p.m.
1894	23	9	11th September.
1894	19	0	17th October.
1898	26	6	2nd September.
1900	34	0	9th July.†
1901	17	4	29th August.
1903	18	0	20th September.
1906	29	2	5th October.
1907 1908	No flood.		

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* Mr. Jevons quotes from the *Sydney Morning Herald*. Flood of 1852 being 8 to 10 feet higher than that of 1844; taking 9 feet as the mean of 8 or 10 the flood of 1844 must have been 40 - 9 = 31 feet.

† Due to the great snowstorm on the mountains.

Dubbo River Gauge.

(Supplied by Mr. James Heane.)

Three river gauges have been erected at Dubbo. The first was washed away in a flood; the second, which was painted on the bridge piers, faded away for want of renewal; and the third is now standing. All these have been connected carefully, I think, and the present gauge only records 45 ft. 6 in. A former one was put up to 48 feet, I think, which would have required the floodwater up to the railway bridge to reach it. My record-book, as Observer for the Water Conservation Branch of the Public Works Department, only goes back to 1893; but the Department supplied me with the following record:—

		ft.	in.
Flood at Dubbo—	December, 1886	36	0
	September, 1887	38	3
	March, 1890	42	0
	December, 1892	45	6

According to local marks known to myself, the 1867 flood was about 6 inches higher than the 1892 flood at Dubbo.

I think it would be well to define how many feet at Dubbo will cause the river to break its banks. Thirty-four feet about Dubbo only submerges low-lying land and causes no flood to do damage; 18 feet of water at Dubbo, continuing about that level for a few days, puts a large quantity of land under water below Warren; anything over the 18 feet at Dubbo must leave the river (before reaching Warren) at the different breakaways on both sides of the Macquarie, gradually rising till it takes 36 feet to run into Buddah Lake Cowal at Timbriebungie, and 42 feet into the Backwater above Narromine.

FLOODS ON THE CLARENCE AT GRAFTON.

(Collected by Mr. G. C. Syer.)

— Aug., 1857.
14th Feb., 1863, 23 feet.
17th April, 1867.
16th July, 1876, 24 feet.
21st Jan., 1887, 24 ft. 10 in.
22nd July, 1889, 19 ft. 1 in.
4th March, 1890, 25 feet.
4th April, 1892, 21 ft. 3 in.
4th Feb., 1893, 11 ft. 1 in.
12th Feb., 1893, 22 ft. 10 in.
18th Feb., 1893, 24 ft. 10 in.
12th June, 1893, 23 feet.

No gauge previous to 1890. The water in the principal business street of the town ranged from 2 feet to 12 feet in 1890. A ridge along the river bank had only a few inches.

The reference mark was erected after the 1889 flood, and recorded in white paint.

The estimated loss of the maize crop in 1893 was 95 per cent.; value, £150,000. The greatest damage to personal property was in 1876 and 1887, as goods were not packed up high enough, and in 1876 the flood rose rapidly.

No very remarkable damage was done in other parts of the river. From newspaper reports, which are made directly after floods, and always make the most of the catastrophe.

In 1887 the river at Copmanhurst was 80 feet high, or 2 feet higher than 1876. The Orara was 2½ feet higher than 1876; the Nymboid not as high as 1876. In 1889, Tabulam, 68 feet; Copmanhurst, 62. In 1890, Tabulam was 42 feet; Copmanhurst, 76 feet; Orara higher than 1887.

In different reports the highest point varies by some inches, and different people give different accounts.

The greatest loss by floods is when they occur from January to April; but as now the dairying industry has become a large source of revenue, the loss will be severely felt at any season.

Phenomena Observed at Langley, near Guyra, by Donald Stewart, Esq.

Year.	Floods.	Moderate Rains.	Fine Days.	Frosts.	Snow.	Hail-storms.	Thunder-storms.	Remarks.
		No. of Days.	No. of Days.	Days.	Days.	Days.	No.	
1871 ..	2	58	307	2	..	..	1	Floods, 8th and 9th August
1872 ..	2	66	300	4	5	2	2	Floods, 6th January and 21st December; high flood
1873 ..	..	54	311	2	3	..	3	
1874 ..	2	50	315	22	2	..	5	Floods, 11th February; also 4th July
1875 ..	..	50	315	19	5	..	1	
1876 ..	1	58	303	14	2	2	2	Flood, 17th July
1877 ..	1	59	306	5	4	..	1	Flood, 12th December
1878 ..	1	52	313	27	4	..	..	Flood, 23rd February
1879 ..	3	82	283	14	4	1	4	Floods, 12th April, 23rd May, and 23rd September
1880 ..	..	41	325	28	2	..	3	
1881 ..	..	34	331	30	3	..	8	
1882 ..	..	68	297	19	4	2	..	
1883 ..	..	70	295	47	5	3	2	
1884 ..	..	60	306	41	3	4	..	
1885 ..	..	59	306	57	3	..	..	
1886 ..	3	79	286	23	..	3	3	Floods, 16th and 17th June; also 7th October
1887 ..	1	76	289	39	3	..	2	Flood, 29th December
1888 ..	1	49	317	68	2	2	1	Flood, 7th February
1889 ..	1	74	291	60	2	..	..	Flood, 2nd June

Please observe, before this date only rain and fine are recorded for the year. All days under the other headings are observations and remarks. After the above date, or on the following dates, all days, under whatever headings, count for the year. Sundays are exempted.

Year.	Floods.	Moderate Rains.	Fine Days.	Frosts.	Snow.	Hail-storms.	Thunder-storms.	Remarks.
1890 ..	3	78	179	44	9	1	..	Floods, 15th and 17th February and 26th March; severe frosts, September and October
1891 ..	2	60	207	34	7	1	..	Floods, 14th and 15th September
1892 ..	..	57	210	36	6	2	..	
1893 ..	..	70	190	41	4	7	..	
1894 ..	..	47	193	61	8	4	..	December.—Several severe hailstorms
1895 ..	..	38	182	87	7	..	..	May.—Very severe; stock dying; snowstorm, 4th November
1896 ..	..	46	161	89	12	2	..	June, July, and August.—Very severe on stock
1897 ..	..	39	185	85	3	1	..	Dry February, March, and April, with slight rain; May and June frosty; 26th July, rough, snow and rain; July and September frosty
1898 ..	..	37	205	70	2	..	..	First six months dry; June very cold; July, snow; last four months dry and hot
1899 ..	1	44	214	45	7	1	..	Flood, 28th October; first four months dry; May and June trying on stock; August very severe
1900 up to 16th Oct.	2	31	163	46	5	2	..	January, February, and March, dry; 10th April, cyclone, travelling east; 16th April, snow; May, June, and July, dry, with some snow; August, September, and first part of October, dry; floods, 18th March and 31st July

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